Mar 1979
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creative computing

the #1 magazine of computer applications and software

FLAG...ERROR... DAC
COBOL
TV...BAR CODE...CRC
DISTORTION...FLAG...
PC...CASSETTE...NOP
DIAGNOSTICS...BYTE.
EUROMICRO...BRANCH
CHECK SUM...DIGITAL...
MONOLITHIC MEMORIES
DATA LINK CONTROL..DC
COMBINATIONAL LOGIC..
DIGITIZER..BACKUP COPY
DATA ACQUISITION..AC
OPTO—ISOLATOR...
PARITY ERROR..
FLOPPY-DISK
POWER-FAIL
MNEMONIC
DATA-SET
QUAD LEFT.
SAMPLING
EUROMATIC
ZERO FLAG...
USASCII

Data Base Management
- Data Files
- Saving Space
- In-Memory vs Disk Files
- Four Systems

Sports Judging on a Microcomputer

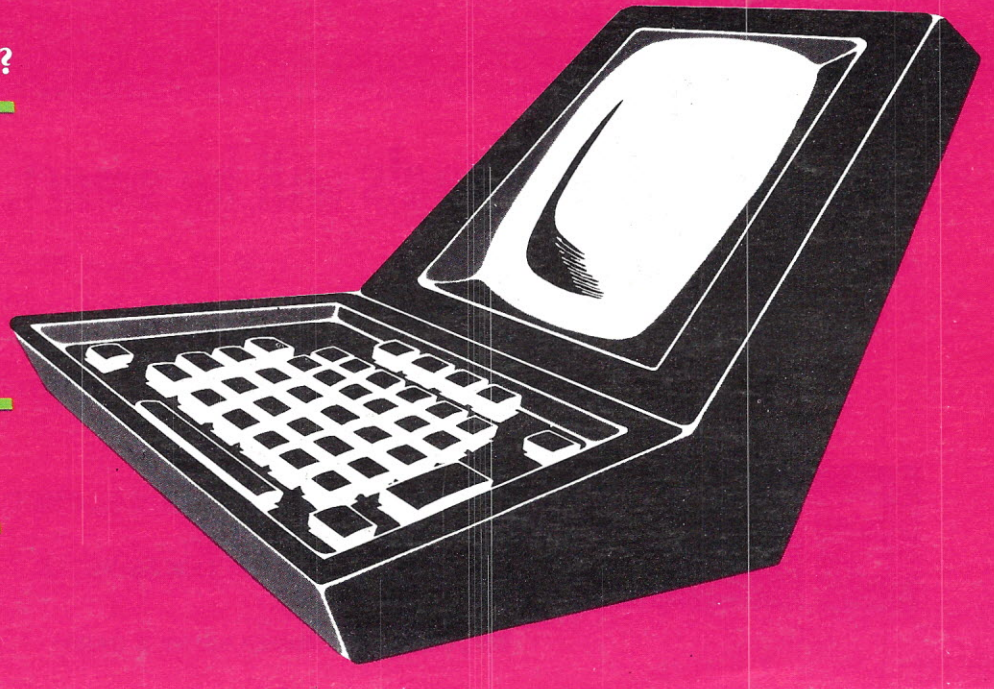
Shopping for a Payroll System

The Game of GO: Can it be programmed?

Evaluations:
- Terrapin Turtle
- VideoBrain
- PET Monitor
- TRS-80 Floppy Disk
- Apple Floppy Disk

Social Science Survey Program

Business Computing with the Sorcerer



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CIRCLE 139 ON READER SERVICE CARD

Here's how you can be fully computerized for so much less than you thought

BUSINESS — EDUCATION — ENGINEERING — MANUFACTURING

We are pleased to announce the first professional time-sharing system in the microcomputer field.

Naturally, it's from Cromemco.

This new multi-user system will do all of the tasks you usually associate with much more expensive time-sharing computers. Yet it's priced at an almost unbelievably low figure.

Look at these features:

- **You can have up to 7 terminals plus a fast, 132-column line printer**
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- **You have confidentiality between most stations**
- **And, make no mistake, the system is fast and powerful. You'll want to try its fast execution time yourself.**

Multi-User BASIC

PROGRAMMERS LOVE OUR BASIC

This new system is based on Cromemco's well-known System Three Computer and our new Multi-User BASIC software package.

Programmers tell us that Cromemco Multi-User BASIC is the best in the field. Here are some of its attractions:

- **You can use long variable names and labels up to 31 characters long — names like "material on order" or "calculate speed reduction."**
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- **No round-off error in financial work (because our BASIC uses binary-coded decimal rather than binary operation). And we've still been able to make it FAST.**
- **Terminals and printer are interrupt-driven — no additional overhead until key is pressed.**
- **The conveniences in this Multi-User BASIC make it much easier to write your own application software.**
- **A line editor simplifies changes.**

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Tinker, Tailor, Soldier, Sailor . . . Doctor, Lawyer . . . the Chieftain's here.

No matter whether you're a serious hobbyist or a serious businessman, the Chieftain 6800 microcomputer with capabilities that surpass the Z-80 is made for you.

Smoke Signal's quality-packed Chieftain I features two 5.25-inch mini-floppy drives and Chieftain II features two 8-inch floppy drives.

Both microcomputers provide 32K static memory, two serial I/O ports, a 2 MHz processor board, a 2K RAM monitor, a nine-slot motherboard with built-in baud rate generator and gold connectors for high reliability. The Chieftain's stylish leather-grained cabinet houses the above with its own cooling fan and regulated power supply.

Every Chieftain is complete with system software and is totally burned-in as well as tested to further insure high reliability.

And it's expandable to 64K memory with up to 2 megabytes floppy disk storage.

So see your nearest Smoke Signal dealer, he'll be glad to show you how to get your wampum's worth. Systems start at $2,595.

☐ Send information on your Chieftain microcomputer
☐ Send name of nearest dealer

Name _____

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Dealer inquiries invited.

Hail to the Chieftain

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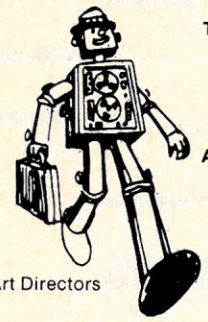

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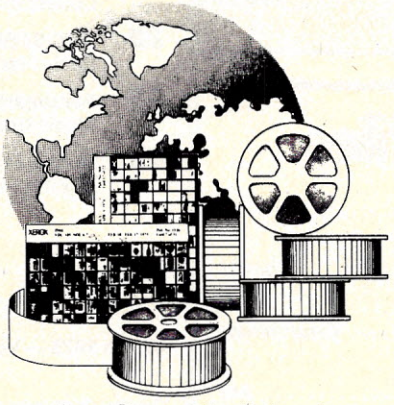

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NCC '79 PERSONAL COMPUTING FESTIVAL

The Personal Computing Festival of the 1979 National Computer Conference, to be held June 4-7 in New York City, will take place at the Americana Hotel. The Committee is headed by Richard A. Kuzmack, senior economist with the MATHTECH Division of Mathematica, Inc., Arlington, Va. Burchenal Green, managing editor of *Creative Computing* Magazine, Morristown, N.J., will serve as Vice Chairwoman.

Other members of the Festival Committee include: *Program Cochairmen* - Jay P. Lucas and Russell E. Adams, both of the U.S. Patent and Trademark Office, Arlington, Va.; *Demonstrations Cochairmen* - Edward J. Fox, Department of Defense, Ft. Meade, Md., and Joe Kasser of Comsat Labs, Silver Spring, Maryland; *Operations Chairwoman* - Harriet Shair, The Computer Corner, White Plains, N.Y.; and *Publicity-Publications Chairman* - Charles Floto, Phillips Publishing, Inc., Washington, D.C.

The Personal Computing Festival will feature technical program sessions plus applications demonstrations and commercial exhibits. Participants will examine the growing role of microcomputers in such areas as aids for the handicapped, education, investment analysis, computer music, professional applications, and small business systems.

The Personal Computing Festival will offer answers to the questions most frequently asked by individuals who use or own personal computers, such as, "What do you do with it?" and "Is it worth it?" More than 25 Festival sessions will focus on applications of microcomputer technology and will feature participation by experts with hands-on experience.

New this year will be awards for the best papers accepted for publication in the *NCC '79 Personal Computing Proceedings*. Valuable prizes, contributed by NCC exhibitors, will be awarded at the Festival for top papers in several subject areas and for outstanding non-commercial applications demonstrations.

Further information on the NCC '79 Personal Computing Festival may be obtained by contacting AFIPS, 210 Summit Avenue, Montvale, N.J. 07645; 201/391-9810.

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Color. VP-590 add-on Color Board allows program control of 8 brilliant colors for graphics, color games. Plus 4 selectable background colors. Includes sockets for 2 auxiliary keypads (VP-580). $69.*

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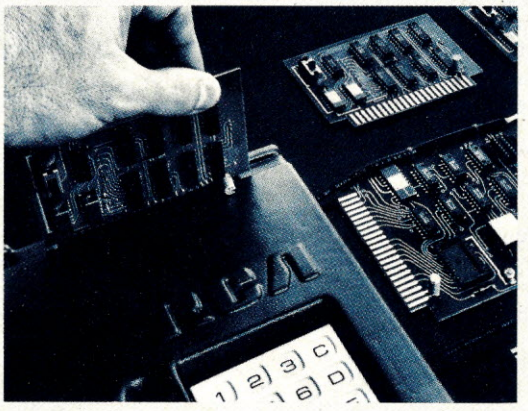
COSMAC VIP lets you add computer power a board at a time.



With these new easy-to-buy options, the versatile RCA COSMAC VIP (CDP18S711) means even more excitement. More challenges in graphics, games and control functions. For everyone, from youngster to serious hobbyist. And the basic VIP computer system starts at just $249* assembled and ready to operate.

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Check your local computer store or electronics parts house. Or contact RCA VIP Marketing, New Holland Avenue, Lancaster, PA 17604. Phone (717) 291-5848.

*Suggested retail price. CDP18S711 does not include video monitor or cassette recorder.
**Available 1st Quarter, 1979.

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CIRCLE 165 ON READER SERVICE CARD

The $6,995 DP Center.

The IMSAI VDP-80

Until now, owning real computing power meant paying unreal prices. The IMSAI VDP-80 Video Data Processor is a complete computer, intelligent terminal and megabyte floppy disk mass storage system including disk operating system (IMDOS) and BASIC software. All in one compact cabinet. All for just $6995.* A complete desk top DP center.

For small business applications, the VDP-80 places a stand-alone computer at your fingertips. And, our full line of add-on peripherals assures that the system can be expanded as your needs do.

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□ **Powerful, High-Speed, Central Processor.** 3mHz Intel 8085 microprocessor. 32K or 64K RAM memory. Parallel and serial I/O. Asynch, synch, and bisynch communications. Programmable baud rates (.05-56 KB).

□ **Megabyte Mass Storage.** PerSci dual floppy, double density disk drives standard. One million byte storage capacity. Three dual floppy drives can be added-on providing 4 million bytes of on-line storage.

□ **Drives, Printers, Plotters, Terminals, Modems and Tape Drives.** Supports up to six terminals or modems, and four tape drives. Drives plotters, serial printers and line printers (up to 300 lpm).

□ **12″ CRT, 24x80 Field, Memory-Mapped, EPROM Controlled Font.** Character and line insert/delete allows fast program correction and text editing. Inverse video and programmable field allows highlighting or enlarging graphic information display. Titled fields protect information blocks from being written over accidentally. EPROM controlled font (up to 256 different characters) allows foreign language and special purpose character forms. Video board includes 4K memory-mapped refresh RAM.

□ **Alphanumeric Intelligent Keyboard.** 62-pad main keyboard. Programmable 12-pad control keyboard. Standard typewriter and calculator keyboard layouts. N-key rollover reduces operator error during high-speed data entry.

□ **Commercial BASIC, FORTRAN IV, IMDOS Software.** Built-in ROM monitor allows extensive debugging and diagnostics. BASIC, interactive or compiler version. FORTRAN IV, Level 2 Ansi compiler. IMDOS - IMSAI's multi-disk operating system.

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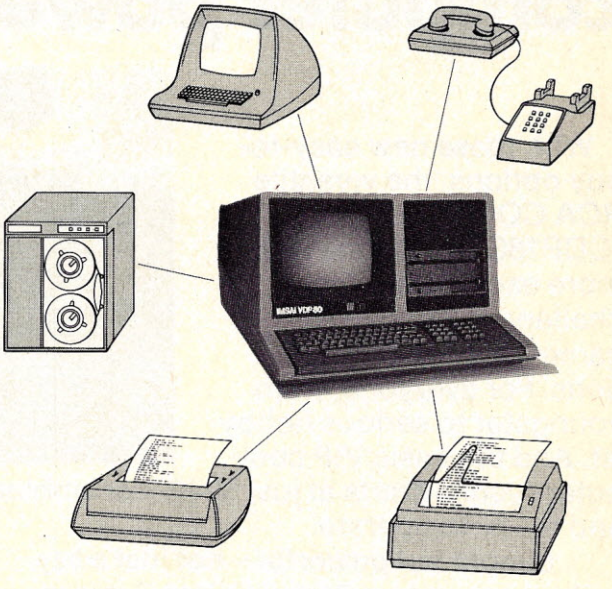
*Base price VDP-80/1000 $6,995, with 32K RAM memory and dual double density floppy disk drive. U.S. Domestic Price Only.
Features and prices subject to change without notice.



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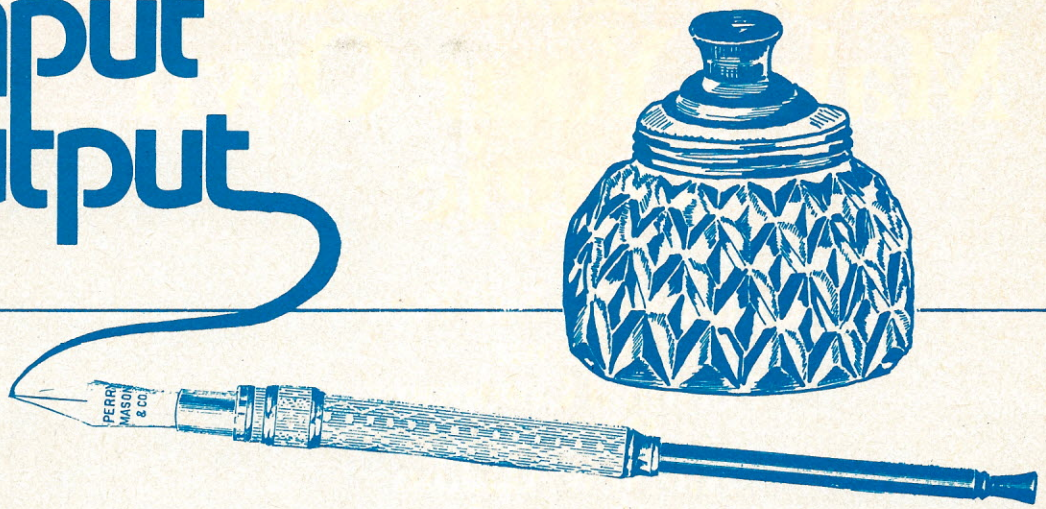
Input Output



Programmers, Attention! Helping In Developing Stock Analysis Programs

Dear Editor:

There are 20,000,000 investors and speculators in the stock market and hundreds of thousands speculating in commodities (with hardly anything resembling a system). Where are all the scientists, computerists, system analysts and sophisticated programmers? Come out of the wings! You keep it a secret and I keep it a secret and the sum of our knowledge is X plus Y. If we communicate then the sum becomes X plus Y plus 2. Two is the added factor of knowledge which is created and which neither of us had before. I have developed several outstanding models that are not theoretical. I'll gladly exchange ideas, rationales, methods, etc. Let me hear from you.

C. Neil
Box 407
New York NY 11363

An Old Problem Rearing Its Head: BASIC Conversions

Dear Editor:

I am waiting for one of the computer magazines to run articles on converting or changing from one BASIC to another. For example, I own an Apple II but have problems using programs written with other BASICs. A good article on the differences and conversions would be very welcome.

Ernest Hufnagel
11 Post Road
Pompton Plains NJ 07444

You're right, Ernie, and we're always on the lookout for such articles. There have been some...but not enough. You might want to investigate a book by Dr. David Lien called "The BASIC Handbook" (Compusoft Publishing, 8662 Dent Dr., San Diego CA 92119. $14.95 + $1.35 P&H). The book is devoted to the kind of conversions you're interested in. We haven't had a chance to get it reviewed yet...but we will. — JTC.

A TRS-80 Transplant to a PET!

Dear Editor:

I am hoping that you can help me as well as some other computer owner. I have, by virtue of the fact that I installed my 16 K RAM myself, the 4K RAM chips from my TRS-80. They are burned in and were removed with all static guards used. My problem is that I have heard conflicting reports about who can use these chips. For instance, I was told that a PET owner could use them to increase his RAM. Is this true?

Perhaps if any reader could use the chips they could contact me and something could be arranged. I certainly have no use for them and would like to sell/trade or whatever.

I used to buy all your editions at the Computerland down the street, but I have moved, so count me as one of your satisfied subscribers. Keep up the good work.

Jerry Dawson
6425 Rogue River Highway
Grants Pass, Oregon 97526

The PET uses 6550 and 2114 4K RAM chips. I didn't have much success finding out the exact part number for the TRS-80 chip. However, I have it from a reliable source that they are the same. — JTC.

Information About Computers in High Schools Wanted

Dear Editor:

As an avid reader of *Creative Computing* I turn to you for some information. We have a Hewlett Packard 21 MX with 5 terminals that are used in science and math courses and by students on their own projects at Schreiber High School. I would like to get a list of other high schools that make extensive use of computers so we may compare ideas and programs. Perhaps a national organization could be set up that could sponsor computer teams competing against one another. Also there could be much exchange of software and ideas on how to best utilize the systems that are available.

I would appreciate either a list giving names of high schools that have computer systems or a note in the magazine asking school computer people to send me their name and school. I would then take it upon myself, with the help of our high school computer club, to see if we could get something going.

Paul D. Schreiber High School
Port Washington NY 11050

Any avid reader of Creative Computing *should have read about the following:*

1. A directory of exemplary institutions using computers for learning and teaching called "Academic Computing Directory" is available for $3.95 from HumRRO, 300 N. Washington St., Alexandria, VA 22314. This includes very complete information on 165.

2. At least three national organizations (ACM, AEDS and IEEE) already sponsor programming and other computer contests for individuals and teams. In addition many regional fairs and contests are sponsored by both academic (NCTM, etc.) and personal computing organizations.

3. At least five publications in addition to Creative Computing *publish excellent material for use in el-hi school computer programs:* Recreational Computing and Calculators/Computers *(P.O. Box 310, Menlo Park, CA 94025),* Oregon Computing Teacher *(c/o Karen Beisse, 594 Empress St., Eugene, OR 97405),* Popular Computing *(Box*

How to buy a personal computer.

Suddenly everyone is talking about personal computers. Are you ready for one? The best way to find out is to read Apple Computer's "Consumer Guide to Personal Computing." It will answer your unanswered questions and show you how useful and how much fun personal computers can be. And it will help you choose a computer that meets your personal needs.

Who uses personal computers.

Thousands of people have already discovered the Apple computer—businessmen, students, hobbyists. They're using their Apples for financial management, complex problem solving—and just plain fun.

You can use your Apple to analyze the stock market, manage your personal finances, control your home environment, and to invent an unlimited number of sound and action video games. That's just the beginning.

What to look for.

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*Apple II plugs into any standard TV using an inexpensive modulator (not included).

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272, Calabasas, CA 91302), Computer Education *(c/o The Computer Education Group, North Staffordshire Polytechnic Computer Centre, Blackheath Lane, Stafford, England).*

4. The National Computer Education Conference will undoubtedly have a fair number of papers of interest to people at the el-hi level. Write for information.

5. The ACM Elementary and Secondary Schools Subcommittee has working groups in virtually every area of el-hi computing. For information, write David Morsund, Dept. of Computer Science, University of Oregon, Eugene, OR 97403.

—DHA

Man Bites Computer

Dear Editor:

I realize that maybe this letter should be addressed to the Tandy Corp., but I thought it might get a better response from you. It is not intended to be a complaint, it is actually a request for assistance or an inquiry as to where or how to get it.

About three months ago I bought a 4K Level I TRS-80. Let me go back even further. I was one of those guys who paid $12.50 back in the forties for the first Reynolds ball point pen. I was also one of those guys who not so many years ago bought a hand held calculator for $100, threw it in the wastebasket a year later, and replaced it with a better one (and one that worked) for about $15.

I now suspect that I am once again one of those "guys." That's OK though, I sort of suspected that when I bought it. That's not what bothers me. What does bother me, is now that I have it, what good is it? What can I do with it? Who gets their kicks out of playing blackjack with a machine for funzies? I'll take Reno anytime. Besides, at Reno they give you free booze while they are taking your money.

As far as I can determine this machine can't wash the clothes, or dry the dishes; it can't turn the coffee on in the morning or the lights off at night. It can't lock the doors, clean the oven, or sound an alarm. What can it do for me? I know — for only $1,598 more I could buy an expansion interface and a line printer (grand total of $3,153 including state tax) and I could use it for an electric typewriter. No, I already have one of those. I think I would rather spend it on a TV recorder. That way I could watch the daytime programs like Bozo the Clown and Popeye. If it's fun you're looking for, they're more fun than watching a rectangular dot bouncing around simulating a ping-pong ball. Besides that, they're "talkies." I learned arithmetic a long time ago, so I don't need that. And a recipe multiplier? Are they serious? Talk about garbage in! I don't want an adult's toy (for a child's mentality).

If you say the Level I User's Manual is the best thing around for learning BASIC, I will accept that. But I went through it twice doing all the little things it said to do, and I still consider myself completely ignorant when it comes to computers and programming (I read an article in your magazine, and it could just as well have been in Latin. I don't understand it either).

I reasoned (erroneously?) that this machine should be able to do almost anything I wanted it to do. I figured its limitations were my knowledge and imagination as to how to do it and what to have it do. One day, a few weeks ago, I thought (I'm trying to upgrade my ham license), hey, why can't I get this thing to send me random letters and numbers in Morse code? Perfect code, at any speed I wanted? Great! So I talked to people — many of them. I even called Ft Worth. (That was a nickel wasted. I was given the number to call by the Radio Shack regional office here in Sacramento. The guy who answers the phone in Ft Worth is like a switchboard operator who cannot refer you to anyone else, and whose main concern in life is answering 200 phone calls a day). A couple people said sure, it can be done. But nobody can tell me how, or even give a clue as to a start point.

I thought maybe, if I upgrade the machine to a 16K Level II that that might teach me a little more about computers, and I could take it from there on my own. What a mistake that was. To me, going from Level I to Level II is like going from pre-school to post-graduate work. Now I'm into this machine for roughly $1000, still know nothing about it, and can do nothing (really functional) with it.

What am I missing? Where did I go wrong? I've seen the advertisements for the tons of literature printed, but where does a beginner begin? I don't need the grade school stuff, but I'm not ready for post-grad work either.

Anybody want to buy a computer? Cheap?

Ron M. Salveson
570 Morris Way
Sacramento CA 95825

For some reason this letter hit a certain chord and I got on the phone and called Ron (mainly to see if he had sold the system...or was still plugging away). I was gratified to find that he's still plugging...and he says he intends to stay with it. Ron reported that he was rather put off by his local computer club and hasn't gone back. That's sad. Newcomers need the help and we're the ones who need to help them. We all lose if someone walks away from personal computing muttering under their breath how technical and confusing it is. —JTC.

Micros For Business ---Yes or No?

Dear Editor:

Controversy over the usefulness of personal size computers for business applications continues. Various opinions have been expressed in many computer magazines and other technical journals. Some have said that personal computers absolutely cannot be used to run a business: Others say of course they can! Obviously, there is some measure of truth to both points of view.

More specifically, the personal size computer can be used to automate any business where failure of the computer or loss of data will not prevent continuation of the business. Prior to installation of the computer, systems analysis should show that:

- Suitable audit trails exist and are functional.
- Supporting back-up data is maintained.
- Manual capability will remain viable.

Also very important, are the techniques used to write the business programs. Every program must include all possible error prevention, detection and correction capabilities. If you can cause a data entry or processing error that goes undetected or is not readily corrected then the program is not for you. Error protection must be built into the program because it's not usually built into personal computer hardware. Including error correction and protection in programs is expensive but so is loss of your business.

Most of the personal computer "Business Programs" that I have seen so far are nothing more than utility routines. Some very good, some not so good. But none were really suitable for more than quickly processing data and records. To rely on them for operating your business would be inviting early retirement. Utility routines however, can have a significant impact on business operation. A system of utility routines can provide a useful management decision making tool. Use the computer to provide immediate data about your business operations. This is one way to handle the problem of real-time management decision-making.

Answering the question then, whether a personal computer can be used to run a business, is not an easy yes or no. Systems analysis, intelligent research and a lot of common sense will help you with the answer.

Chuck Carpenter
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Interfacing Update

Dear Editor:

In January, 1979 you ran my article "Who Needs Interfacing Problems?" You may be interested in a note of update:

My problem with interfacing a Selecterm with my H8 eventually led me to buy another computer (Xitan). After some shake-down problems with that, and even less help from vendors or manufacturers in getting up and running, I have been operating full-time since August. I kept the Heath, however, and now and then tried to make it work. Reliability kept declining, along with my enthusiasm.

A month ago, in a conversation with a fellow-member of the local Heath User's Group, I picked up an idea — the voltage regulator on the CPU card is a plug-in affair, rather than soldered. My friend suggested checking the plug contacts. The H8 comes with the CPU fully assembled, and with a warning that to attempt to repair it will void the warranty. Since the warranty had expired, I took the friend's suggestion, cleaned and strengthened the connectors, and the computer has been running perfectly ever since.

Two morals: For amateurs, clubs can be among one's most valuable resources; and, Don't take anything for granted — in this world you are on your own.

My present evaluation of the H8: a well-designed machine, for all its lack of buss compatibility. Its outstanding features relate to its target market — the neophyte. Front panel keypad and digital display, tested system compatibility, even to specified cassette recorders, generous operating tolerances. (You have to try hard to make a load fail.) My big complaint now is, as a writer, I am not happy with its text editor. The Zapple in my Xitan is far more powerful.

I'm learning assembly-language programming now, so I can design my own...

Don Skiff
2448 Vera Ave.
Cincinnati, OH 45237

Fortran and Basic Are Languages!

Dear Editor:

One statement in a recent *Creative Computing* obscures a very basic concept of high-level language programming. Dr. Hogg (Jan '79, p.62) says "the largest difference between FORTRAN and BASIC is that the former is a compiler while the latter is an interpreter". Nonsense. Fortran and Basic are languages. Fortran is most commonly implemented via a compiler, while Basic is most often interpreted.

It is very important not to obscure the distinction between a language and its implementation. People used to claim that PL/I was an inefficient language when actually they were describing the behavior of IBM's PL/I F-level implementation. Honeywell had an excellent optimizing PL/I compiler at the time which, unfortunately only worked on MULTICS so no one knew about it.

One further nit to pick: Hogg says "the uppercase is easier to read anyway". Nope, wrong again. Upper may be easier to read than lower on a limited font dot-matrix display, but in general, lower case is much easier and faster to read (for humans, that is). A story I heard many years ago when I worked at Bel Labs: When the Bell System was first putting together the earliest Teletype, they did some formal testing and discovered that lower case was much more easily comprehended than upper case. With a very limited character set they had almost decided to use lower case only despite proper nouns. Then someone said, "How about God?" — and upper case it was.

Richard L. Wexelblat
Sperry Univac
P. O. Box 500
Blue Bell, PA 19424

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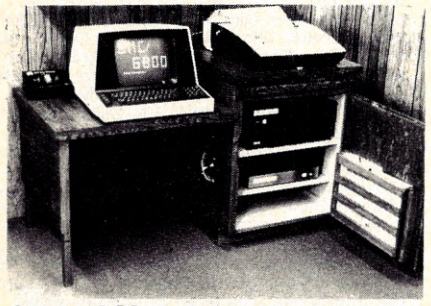

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The library includes business and finance programs, mailing list programs, math, programming utilities, a PILOT interpreter, a Palo Alto Tiny Basic interpreter and an enormous number of games. Computer games are still a pet fancy among computer hobbyists and amateur programmers.

Further information can be obtained by sending a self-addressed stamped envelope to J. Dvorak, Authorized NSUG Program Library Distributor, 704 Solano Ave., Albany, CA 94706.

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If you need the power, speed and versatility of a 16-bit machine, there's nothing better than our H11A. Based on the famous DEC LSI-11/2, the H11A provides complete DEC compatibility and access to the thousands of practical software programs and applications that entails. Along with our own complete systems software and our line of DEC-compatible peripherals including the DEC Writer II and our new floppy disk, you'll have state-of-the-art computing power at its very best!

OUR PERIPHERALS

The Heathkit Computer peripherals offer the same competitive advantages of our two computers. Our H9 CRT terminal, H10 paper tape reader/punch, ECP-3801 cassette storage recorder/player, and our new WH14 line printer, plus the new floppy disk storage systems all give you the quality, performance and value that Heath company is famous for. And we sell the memory, I/O interfaces and accessories you need to custom design a system to your particular specifications!

ALL THIS, PLUS HEATH DOCUMENTATION, SERVICE AND SUPPORT

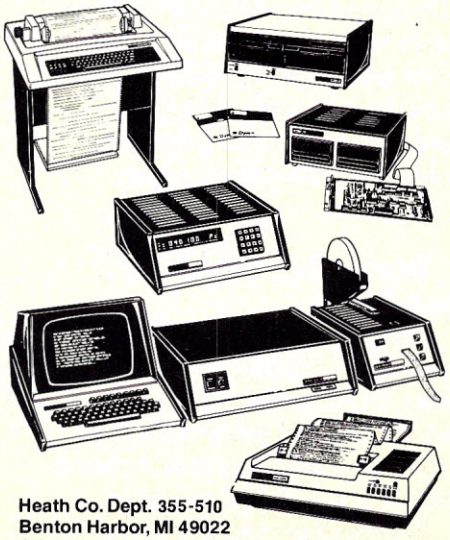
One of the most important parts of ANY computer system is documentation. And Heath documentation is quite simply, the best around. If you buy our computer products in kit form, you get a comprehensive step-by-step assembly manual that takes you every step of the way from unpacking to final plug-in. The knowledge you gain in building your Heathkit computer is invaluable–for service if it's ever needed, for quick troubleshooting and correction, and just for understanding the workings of the machine. In both our kit and fully assembled products, our comprehensive operating and instruction manuals are fully detailed, thorough and accurate. This documentation, plus Heathkit technical consultants and service nationwide, make your Heathkit computer system one you can depend on–to work right the first time, and to last for years!

GET YOUR FREE CATALOG

Read all about these Heathkit computer products and peripherals in the new FREE Heathkit catalog. Write Heath Company, Dept. 355-510 for your FREE copy. Or visit your Heathkit Electronic Center (Units of Schlumberger Products Corporation).

HEATHKIT COMPUTERS

Systems Engineered for Personal Computing



Heath Co. Dept. 355-510
Benton Harbor, MI 49022
CP-160

CIRCLE 162 ON READER SERVICE CARD

is called for and complete writes and rewrites of programs are accomplished in a fraction of the normal time required by conventional means without a data base.

The KFAM window lists the subroutine entry points residing in KFAM. These WINDOW call points assist the application programmer by allowing entry to routines that:

1. handle file manipulation
2. open and close files
3. read and write records
4. add or delete records
5. control cursor position
6. automatically dimensions memory for file buffers.

COMPUSOFT offers a toll free number to assist users in utilizing the KFAM. General business application packages and specialized business packages are also offered. The toll free number will also be available to purchasers of application software. Updates will be sent to all purchaser's of full packages.

KFAM user manual, $50 (credited if KFAM purchased): KFAM package on disk (includes user manual) $275: Business applications (manual listing library and sample reports) $15.

KFAM operates on the following systems and is presently being converted to other major hardware systems:

a. North Star Disk System
b. North Star Horizon
c. TRS-80 Disk w/BASIC-II.

COMPUSOFT, Building 2200-A, 6710 Dorchester Road, Charleston, S.C. 29405. 1-800-845-8950.

CIRCLE 236 ON READER SERVICE CARD

MULTI-TASKING MONITOR FOR 8080 / Z-80 PROCESSORS

A Real-Time Monitor (RTM) program is now available from Oasis Systems. The RTM program forms the basis for multi-processing systems which can perform many separate processes at the same time. RTM enables the user to think in terms of "TASKS" which are independent programs that run simultaneously inside of one microcomputer. RTM does the difficult job of dividing up time and resources between these tasks.

RTM features include the ability for tasks to communicate via "Messages," Synchronize each other with P and V operations and schedule time dependent processes. RTM can also function with or without a real-time clock.

RTM is self relocating and generates a kernal system less than 1300 decimal bytes in size. RTM is completely ROM compatible which makes it great for OEM applications. All operations are invoked with simple CALL's which as a bonus are compatible with Microsofts (TM) FORTRAN IV.

A complete package is available with documentation on CP/M diskette $75. Documentation only $15. Papertape and CUTER™ cassette versions available. (California residents please add sales tax.)

OASIS SYSTEMS, 2765 Reynard Way, San Diego, CA 92103.

CIRCLE 237 ON READER SERVICE CARD

DATA MANAGEMENT AND SORT/MERGE IN MICROPOLIS BASIC

The Data Management System will manage an unlimited number of files for any applications. Each file is defined by the user, who specifies the file name and up to 24 fields for each file. Each of these fields is assigned a name (one meaningful to the user ... even in a foreign language) and other attributes. Records may then be added, deleted, updated, scanned for, or inspected using the field names and/or record numbers. Any of the files may be easily accessed by other user programs for specialized applications.

Also part of the DMS is a report writer. Reports and/or labels can be produced for any file defined to the system. The user selects fields to print, titles, column totaling and sub-totaling, editing and other options.

The Sort/Merge system will sort any file, whether defined to the DMS or not. Any size file can be sorted using up to 10 sort keys. The Sort/Merge program is an integral part of the DMS system.

Both systems are field proven with many satisfied users. The system is provided on a diskette with comprehensive documentation. A CP/M version is currently under development. $150.

Creative Computer Applications, 2218 Glen Canyon Road, Altadena, CA 91001.

CIRCLE 238 ON READER SERVICE CARD

NEW VECTOR GRAPHIC DISK OPERATING SYSTEM

A new disk operating system for the Z-80 and Micropolis disk drives, featuring complete compatibility with software written for the North Star DOS, has been introduced by Vector Graphic Inc., designers and manufacturers of computers and peripherals for the personal and small business markets.

The new operating system, called MZOS, is designed to support the Vector MZ computer system or a similar configuration, and incorporates several innovative features to upgrade system performance such as implied execution which permits a file to be executed by just typing the name, rather than using the old 'GO' command. MZOS allows the directory to be listed in two different formats, either in a two-column format for viewing 32 entries at once or in a six-column 'fast' format. In addition, the drive is recalibrated each time the directory is listed so that any drive may be set to the default, eliminating the need to reload.

The Micropolis drives hold 315K bytes apiece, providing over 3.5 times the storage of a conventional Shugart drive and seven times the storage in a dual system. In addition, four drives may be supported rather than just three.

Price for the MZOS is $60.00, and can be purchased from any authorized Vector Graphic dealer or factory direct.

For more information, contact Yvonne Beck at Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361. (213) 991-2302.

CIRCLE 239 ON READER SERVICE CARD

PASCAL/Q™: PASCAL FOR MICROCOMPUTER SYSTEMS

PASCAL/Q™ is a comprehensive software system for 8080 and Z-80 microprocessor systems, based on UCSD PASCAL. Featured are many refinements and additional features, including QSAM™ structured files and automatic disk file storage allocation (QSAM is an enhanced ISAM access method). Current versions are designed for MITS/Altair, iCOM, and Intel floppy disk systems, and MITS/Altair cartridge disk systems. Implementations for other systems will soon become available. A unique feature of PASCAL/Q is the monthly update service. Each subscriber to the service will receive a monthly diskette containing the latest software updates and a newsletter. The price for PASCAL/Q is $300 for a thirty-year user license and $19/month for the update service. Queue Computer Corp., 1044 University Ave., Berkeley, CA 94710. (415) 845-5300.

CIRCLE 240 ON READER SERVICE CARD

TARBELL BASIC

Tarbell Electronics of Carson, California has announced the immediate availability of Tarbell BASIC on cassette or CP/M Disk. The CP/M version is capable of disk interaction, including saving and loading programs, chaining programs, and loading data. The interpreter occupies 21K of RAM.

Most of the features of ALTAIR Extended BASIC have been implemented in Tarbell BASIC, and several new ones have been added. New features include assignment of I/O, long variable names, cassette string data SAVE, procedures with local variables, and alphanumeric line labels. Additional capabilities, not found in other versions of BASIC, greatly enhance Tarbell BASIC. For instance, two statements, ASSIGN and DROP, let the user assign or de-assign as many as ten physical devices to six separate logical I/O devices. Alphanumeric line descriptors can replace normal line numbers, and the use of lengthy variable names is permitted. These features improve readability and maintenance. The use of procedures allows arguments to be passed to subroutines, and local variables may be declared to enable subroutine libraries to be developed and utilized efficiently. Subroutines may then be appended to Tarbell BASIC programs using a single command.

The I/O section listing, included in the documentation, is easily modified to suit the user's requirements. Good access to the user's machine language subroutine is facilitated by the CALL function.

Both cassette and CP/M Disk versions of Tarbell BASIC are available with complete operating manual for $36 each. The source listing is available as a printout, or on disk, for $25.

For complete information contact Tarbell Electronics, 950 Dovlen Place, Suite B., Carson, California 90746. Telephone (213) 538-4251, or (213) 538-2254.

CIRCLE 235 ON READER SERVICE CARD

CASSETTE MAGAZINE FOR PET, TRS-80 APPLE II

GAUDEUS, STARTING IN MAY - a most economical and fun way to animate your microcomputer.

The monthly issues are to contain at least 10 programs with emphasis in Computer Assisted Instructions mostly under the feature topics of C.A.I. - HOME ECONOMICS - BUSINESS - TRIVIA - GAMES - LANGUAGE (computer) - with programs in Math, Physics, Geography, Chemistry, Cooking Recipes, Nutrition, Speed Reading, Buzz Phrase Generator, Basic Tutor (Also Machine Language in future issues).

As for quality of the programs, we think that our Chemistry tutor is the jewel of the microcomputer software industry.

The subscription's introductory price is to be $30.00 per year.

If you have children, you can't afford to be without Gaudeus. If you have a wife you can't afford to be without Gaudeus, if you are alone, Gaudeus and your computer will keep you company.

A pre-introductory price of $25.00 will insure your being the first on our mailing list, plus an extra C-30 cassette as a bonus. This offer expires April 15, 1979.

GAUDEUS
BOX 113
OZONE PARK, N.Y. 11417

CIRCLE 153 ON READER SERVICE CARD

FORTRAN ROUTINES

Key Bits Inc. announces THE STRING BIT™, a collection of FORTRAN character string handling routines. Included are routines to find, delete, fill, move, separate, concatenate and compare characters and character strings. One routine counts the occurrences of any one string's appearance in another. There are routines to insert, replace and reverse characters and character strings within other strings. Character strings can be truncated, scanned for numeric data, and converted to numbers. Characters can be extracted from the left, from the middle, from the right, and from between any set of specified characters.

THE STRING BIT is ideally suited for applications such as command identification, parsing and interpretation, test editing, character string file management, inquiry systems and report preparation. The package is fully supported by a comprehensive orientation and reference manual. $45.00. For further information contact Key Bits Inc., P.O. Box 592293, Miami, FL 33159.

CIRCLE 242 ON READER SERVICE CARD

CP/M FOR DIGITAL GROUP SYSTEMS

General Technics, Inc. is now offering release 1.4 of the popular and versatile CP/M* floppy disk operating system, configured for Digital Group microcomputers. Digital Group owners using CP/M can readily exchange programs with owners of other systems, and will also be able to take advantage of the wide variety of software that runs under CP/M, including several BASICs, FORTRAN IV, COBOL, business packages, and much more.

This implementation of CP/M is fully compatible with other CP/M systems and runs in any standard Digital Group 8080 or Z-80 system having a minimum of 18K of contiguous memory and one full size floppy disk drive. Audio cassette storage is supported; Phi-deck support will be available soon.

General Technics is distributing, free of charge, an assortment of public-domain software from the CP/M Users' Group, including a Z-80 assembler and the BASIC-E compiler/interpreter.

The Digital Group CP/M package comes complete with diskette, bookstrap ROM, CP/M manuals and supplementary documentation. $100. General Technics, Inc., 1515 W. Main, Peoria, IL, 61606, (309) 673-8080.

CIRCLE 243 ON READER SERVICE CARD

NEW 6800 SOFTWARE FROM PERCOM

PerCom Data Company announced the availability of Hemenway Associates, Inc. software for the Company's LFD-400 mini-floppy disk storage system.

Included in the Hemenway line offered by PerCom are a macro linking assembler, BASIC compiler, text editor and linking loader.

The programs are for 6800-based computers using PerCom's mini-floppy disk storage unit, and are suitable for both business and personal computing applications.

The assembler, designated RA6800ML, generates relocatable and linkable code, and features (user-defined) macro instructions. It resides in 16K of RAM, and uses a hash-coded table to cut execution time.

The BASIC compiler, STRUBAL™ (Structured BASIC Language), generates relocatable code, and separately compiled program modules may be linked to form a single program. STRUBAL™, which requires 16K of RAM or more, implements hash-coded symbol table searches and binary-searched keyword tables.

EDIT68, the text editor, may be used on both data and programs. In addition to Search, Change, Delete and the usual editor functions, EDIT68 supports macros of often-used edit functions.

The linking loader, LINK68, interconnects object modules produced by either the assembler or STRUBAL™ compiler.

STRUBAL™ (includes Run-Time package)	$99.95
RA6800ML Assembler includes MACLIB)	$49.95
EDIT68 Text Editor	$29.95
LINK68	$19.95

PerCom Data Company, 318 Barnes, Garland, Texas 75042, (214) 272-3421. Texas residents must add 5% sales tax.

CIRCLE 244 ON READER SERVICE CARD

OHIO SCIENTIFIC DATA-BASE MANAGEMENT SYSTEM

OS-DMS, Ohio Scientific's data-base manage-system is a system which brings the use of microcomputers down to the level of non-programmers. It allows virtually untrained computer users to store and recall information from any one of Ohio Scientific's full line of floppy and hard-disk microcomputer systems. Each program in the extensive OS-DMS library is aimed at a specific small business application, such as real estate, automotive sales, mailing lists, inventory, accounts receivable/accounts payable, inventory/invoice, ledger, personnel files, retail sales and medical files, to name just a few. Because the microcomputer uses terms familiar to each specific application, the user doesn't have to learn exotic programming languages. The low cost of each program (manufacturer's suggested retail of $300) makes it easy for a business to add on programs as the need arises.

An example of the startling utility of OS-DMS is using it to create a personnel file for a company in conjunction with a specific application such as the OS-DMS payroll program. The system can easily generate other useful information in addition to payroll. Another OS-DMS program called "Query" can be used by an untrained office person to quickly obtain an employee's phone number. An OS-DMS mailing list program can automatically generate mailing labels for all employees. One of OS-DMS's report-writer programs can be used to generate management reports such as employee lists, wage lists, seniority reports, etc. All these tasks and many more can be accomplished by a computer user without any programming knowledge. The person simply makes a few menu selections and answers some simple questions to obtain these results.

Ohio Scientific, Inc., 1333 S. Chillicothe Road, Aurora, Ohio 44202, U.S.A. Phone: 216/562-3101.

CIRCLE 245 ON READER SERVICE CARD

IMSAI'S FORTRAN IV VERSION 2.9

In addition to meeting the ANSI standard, IMSAI FORTRAN IV is a true compiler, with an enhanced disk I/O package, an extensive subroutine library and facilities for generating and managing relocatable object modules. The FORTRAN compiler processes several hundred statements per minute in a single pass and needs less than 24K bytes of memory to compile most programs. Among the compiler enhancements over the ANSI standard are true random disk file access, transfer of control at end of file or error condition, mixed mode arithmetic, hexadecimal constants, LOGICAL variables which can be used as integer quantities, LOGICAL DO loops and sixteen digit double precision arithmetic. IMSAI'S FORTRAN IV is a revised version of Microsoft FORTRAN, with an enhanced disk I/O package. Additional diskette protection and program error security are offered by the file OPEN call that lets the user optionally specify volume, drive and access privileges. IMSAI FORTRAN IV generates RELOCATABLE CODE, enabling the user to write and test programs in modules. If the user changes only one module of a program, only that module need be recompiled. A compatible assembler and linking loader allow the user to link FORTRAN and/or Assembler modules. IMSAI MANUFACTURING Corporation 14860 Wicks Boulevard, San Leandro, California 94577 (415) 483-2093.

CIRCLE 246 ON READER SERVICE CARD

the $988 Surprise . . .

If you haven't looked carefully at the Level-II 16K TRS-80, you're in for a big surprise! Level-II BASIC gives TRS-80 advanced features like comprehensive string handling, multi-dimension arrays, multi-letter variable names, named cassette files, full editing, integer arithmetic, single (6-digit) and double (16-digit) precision arithmetic, formatted printing, memory-mapped video (print directly at any of 1024 screen positions), 128x48 video graphics (may be intermixed with text), error trapping, auto line numbering, TRACE, PEEK and POKE . . . to name just a few. Because Level-II is in ROM, TRS-80 powers-up ready to go with the full 16K RAM available for your use.

This means TRS-80's memory is equivalent to a 28K RAM-based system.

New for 1979—TRS-80's numeric (calculator) keypad included on every 16K computer, and available as an add-on for present owners.

TRS-80's modular design allows easy expansion. Add up to 48K RAM, Expansion Interface, printers, 1 to 4 Mini-Disks, RS232C, telephone acoustic couplers, Voice Synthesizer, dual cassette recorders, our System Desk and Printer Stand. Surprisingly, these are not promises of things to come, but real products being delivered right now. Software from games to General Ledger are available, with more cassette and disk software being added monthly.

Radio Shack's 58 years of consumer electronics leadership, our 50 regional repair centers (growing to 100 this year), our new Radio Shack computer centers, and our NYSE-listed billion-dollar parent, Tandy Corporation, insure that customer support is always available right where it should be—locally.

So if you haven't seriously looked at TRS-80 yet, ask your local Radio Shack for our new 20-page fact-filled catalog and be prepared for a $988 surprise. Surprising power—features—price—support! Level-II 16K systems include everything pictured, plus the manual. Better to be surprised now . . . before you choose the wrong microcomputer system.

16K *Available* RAM
12K Level-II BASIC in ROM
Full-Size Typewriter Keyboard
U.L. Listed, Portable
Complete . . . Plug in and Use

NEW!
Numeric Calculator Keypad

Radio Shack®
The biggest name in little computers™
A DIVISION OF TANDY CORPORATION • FORT WORTH, TEXAS 76102
OVER 7000 LOCATIONS IN NINE COUNTRIES

PRICE MAY VARY AT INDIVIDUAL STORES AND DEALERS.

TWO-PART COMPUTER MUSIC

NEWTECH Computer Systems' new "Americana Plus" music software is now available for use with the Model 6 and Model 68 Music Boards, NEWTECH's S-100 bus and SWTPC-compatible Music Boards. "Americana Plus" contains more than a dozen pre-coded tunes, ready to load and run, including five American favorites arranged for TWO VOICES. Each voice can have a different sound quality, and two Music Boards can be used for stereo. The MD-1NS disk for the North Star Micro Disk system, and the MD-1SW disk for the SWTPC Mini FLEX Disk System (both $19.95) also feature "Jukebox," a user interactive BASIC program that permits easy selection of any tune. The MC-1SW cassette ($15.95) for the SWTPC AC-30 interface contains the same tunes as the MD-1SW disk. An audio demo cassette with the above songs is also available. Model 6 and Model 68 Music Boards, assembled and tested, are available for $59.95 at over 50 local computer stores. Newtech Computer Systems, Inc. 230 Clinton Street, Brooklyn, New York 11201 (212) 625-6220.

CIRCLE 247 ON READER SERVICE CARD

INCOME TAX PREPARATION SYSTEM

Softbyte announces the development of a Federal Income Tax System (FITS) program for the use of Professional Preparers of Federal Income Tax returns. FITS is a disk based system to be used on microcomputers. It is an interactive system which does the calculations for, and prints out Forms 1040, 1040A and Schedules A, B, C, D, E, F, G, R, RP, SE and TC. FITS unlocks the tremendous potential of the microcomputer for the Tax Return Industry. It is available on North Star, Micropolis Metafloppy, full size floppy under CP/M and TRS-80 disks. Price is $285.00 for a disk and operating instructions. FITS provides an option for computer generated forms for which IRS approval has been requested. Delivery will start at the end of November, 1978. Consumer versions of the professional program will also be available. For further information, contact your computer dealer or Softbyte, 315 Dominion Dr., Newport News, VA. 23602

CIRCLE 248 ON READER SERVICE CARD

INVENTORY SOFTWARE FOR 6800

Available NOW — Inventory Software for 6800. Designed to run on SWTPC CPU with Smoke Signal, SW, Percom disks or cassette. Almost any 6800 system that uses basic. Program provides a capacity of up to 1000- 80 character items per disk. Contents are item search, daily activity report, minimum quantity search, list by item, list by class, list by vendor, access a different file, up date a file, create a new file.

PAYROLL SOFTWARE FOR 6800

Available NOW— Payroll Software for 6800. Designed to run on SWTPC CPU with Smoke Signal, SW, Percom disks or cassette. Almost any 6800 system that uses basic. Program will tabulate payroll record, print paychecks, list employee records, summarize employer tax records, create new file, open a different file, and end of year or quarter records.

BILLING SOFTWARE FOR 6800

Available NOW — Billing Software for 6800. Designed to run on SWTPC CPU with Smoke Signal, SW, Percom disks or cassette. Almost any 6800 system that uses basic. Program prints mailing labels, bills, overdue and aging notices. It will furnish reports for customer A/R, sales, and last purchase. Also has file handling capabilities.

Visa and Mastercharge welcome. Each package on disk or cassette for $200, and runs in 16K. Stephen Moe Company, Mail Address P.O. Box 595, Springfield, OR 97477. Offices at 3698 Franklin Blvd. Eugene, OR Telephone 503/726-7613.

CIRCLE 249 ON READER SERVICE CARD

DATA BASE/QUERY SYSTEM AVAILABLE FOR CP/M AND NORTH STAR USERS

WHATSIT — or, "Wow! How'd All That Stuff get In There?" is a self-indexing query system now available in a CP/M compatible model.

Capable of storing up to 25,000 free-format entries, the system typically responds in 4 to 15 seconds to queries, slightly longer for updates.

Want to index your investment portfolio ... computerize your customer list ... organize professional files? WHATSIT can do it, as well as many other chores that demand quick access and easy updating of disc files.

Automatic cross-indexing makes all entries accessible by a variety of conversational query Requests, which may be as simple as: "When's Dr. Jekyll's Appointment?"

Unlike many systems, WHATSIT imposes no predetermined categories or rigid formats. The data structure evolves through normal use of the system, by incorporating index "headings" chosen by the user. Entries may be cross-indexed under any number of headings, and whenever new headings are needed, they can be added in a matter of seconds.

Entries may be as short as a single character or as long as 200 characters, and entries of any length may be freely intermixed without waste of disc space. WHATSIT automatically stores each entry in the smallest possible space.

The Model CP-1 runs in CBASIC and requires a minimum 40K CP/M system with one to four single-density disc drives. The system supports a printer if desired. List price is $125.00, including a clearly written 120-page manual.

Also available is Model NS-3 for North Star systems, offering the same immediate access to data stored on 5-inch discs. List price of the North Star model is $75.00. Both models are available through local computer stores, or through the distributor, Information Unlimited, 331 West 75th Place, Suite 21, Merrillville, IN 46410.

CIRCLE 250 ON READER SERVICE CARD

Get Your Up-Grade Kit Here:

AL: Birmingham: Computer Center, (205) 942-8567; Huntsville: Computerland, (205) 539-1200. **AZ:** Tuscon: Myotis Enterprises, (602) 326-5306. **CA:** Berkeley: Byte Shop, (415) 845-6366; Davis: Capitol Computer Systems, (916) 483-7298; El Cerrito: Computerland, (415) 233-5010; Hayward: Computerland, (415) 538-8080; La Mesa: EDP Management Inc., (714) 462-5400; Los Altos: Computerland, (415) 941-8154; Marina Del Rey: Base 2, (213) 822-4499; Mt. View: Byte Shop Computer Store, (415) 969-5464; Digital Deli, (415) 961-2670; Palo Alto: Byte Shop, (415) 327-8080Sacramento: Capitol Computer Systems, (916) 483-7298; San Diego: Byte Shop of San Diego, (714) 565-8008; San Francisco: Byte Shop, (415) 434-2983; Computer Center Inc., (415) 387-2513; Computer Store of San Francisco; (415) 431-0640; Computerland, (415) 546-1592; San Jose: Electronic Systems, (408) 226-4064; San Rafael: Computer Demo Room Inc., (415) 457-9311; Santa Clara: Byte Shop Computer Store, (408) 249-4221; Walnut Creek: Computerland, (415) 935-6502. **CO:** Denver: Computerland of Denver, (303) 759-4685; Englewood: Byte Shop, (303) 761-6232. **CT:** Fairfield: Computerland of Fairfield, (203) 374-2227; New London: R & R Computer Store, (203) 447-1079. **FL:** Ft. Lauderdale: Computer Age, (305) 791-8080; Computerland, (305) 566-0776; Jacksonville: Williams Radio & TV, (904) 354-5460; Panama City: Boyd Ebert Corp., (904) 769-4492; Tampa: Microcomputer Systems, (813) 879-4301 **GA:** Smyrna: Computerland of Atlanta, (404) 953-0406. **HI:** Honolulu: Computerland, (808) 521-8002. **IL:** Champaign: Byte Shop, (217) 352-2323; Niles: Computerland, (312) 967-1714; Oak Lawn: Computerland, (312) 422-8080; Peoria: Computerland, (309) 688-6252. **KY:** Louisville: Computerland, (502) 425-8380. **MA:** Cambridge: Computer Shop, (617) 661-6270; Waltham: Computer Mart Inc., (617) 899-4540. **MD:** Rockville: Computerland of Gaithersburg, (301) 948-7676. **MI:** Ann Arbor: Newmann Computer Exchange, (313) 994-3200; East Lansing: New Dimensions in Computing Inc., (517) 337-2880; Kentwood: Computerland of Grand Rapids, (616) 942-2931; Royal Oak: Computer Mart, (313) 576-0900. **MN:** Bloomington: Computerland of Bloomington, (612) 884-1474; Minneapolis: Computer Depot Inc., (612) 927-5601. **NB:** Omaha: America Computers, (402) 592-1518. **NC:** Raleigh: Byte Shop, (919) 833-0210. **NJ:** Budd Lake: Computer Lab of NJ, (201) 691-1984; Clark: S-100, (201) 382-1318; Iselin: Computer Mart of NJ, (201) 283-0600; Succasunna: Computer Hut, (201) 584-4977. **NY:** Carle Place: Computerland of Nassau, (516) 742-2262; Elmira Heights: Red Ten Electronics, (607) 734-3566; Ithaca: Computerland of Ithaca, (607) 277-4888; Johnson City: Micro World, (607) 798-9800; New York City: Computer Mart of NY, (212) 686-7923; Syracuse: Computer Shop of Syracuse Inc., (315) 446-1284; White Plains: Computer Corner, (914) 949-3282. **OH:** Cincinnati: Digital Design, (513) 561-6733; Columbus: Mini Micro Computer World Inc., (614) 235-5813; Ohio Microcomputer Specialists, (614) 488-1849; Dayton: Computer Solutions, (513) 223-2348. **OK:** Oklahoma City: Microlithics Inc., (405) 947-5646; Micronics, (405) 942-8152. **PA:** Frazer: Personal Computing Corp., (215) 647-8463; Philadelphia: Microtronix, (215) 665-1112; State College: Micro Computer Products Inc., (814) 238-7711. **TX:** Austin: Computerland, (512) 452-5701; Dallas: KA Electronic Sales, (214) 634-7870; Ft. Worth: Patrick Associates, (817) 531-2761; Garland: Digital Research Corp., (214) 271-2461; Houston: Computerland of SW Houston, (713) 977-0909; Houston Computer Mart, (713) 649-4188; San Antonio: Micromart, (512) 222-1426. **UT:** Orem: Johnson Computer Electronics, (801) 224-5361. **VA:** Alexandria: The Computer Hardware Store Inc., (703) 548-8085; Computers Plus, (703) 751-5656; Arlington: Arlington Electronics Wholesalers, (703) 524-2412. **WA:** Bellevue: Computerland of Bellevue, (206) 746-2070; Seattle: Magnolia Microsystems, (206) 285-7266. **WI:** Madison: Computerland of Madison, (608) 273-2020; Neenah: Fox Valley Computer Store, (414) 725-3020. **CANADA: ONTARIO:** Mississauga: Arisia Microsystems, (416) 274-6033; Toronto: Computer Mart Ltd., (416) 484-9708. **BRITISH ISLES: CHESIRE:** Cheadle: New Bear Computing Store, 061-491-0134. **ESSEX:** Illford: Byte Shop Ltd., 01-554-2177. **HARTFORDSHORE:** New Barnet: Computer Components, 14 Station Rd. **ISRAEL:** Haifa: Microcomputer Eng. Ltd., 31-070. **WEST GERMANY:** Munich: ABC Computer Shop, Schellingstrasse 33, 8000 Munchen 40; Microcomputer Shop, Toelzerstr, 8, D-815 Holzkirchen; Wedel: Digitronic Computer Systems, Bei-der Doppeliche 3-5.

Ithaca Audio

The Simple Up-Grade™

Trying to add computer memory is not much fun if you don't get everything you need.

step directions and diagrams. And if a personality jumper is required, *It's premade.*

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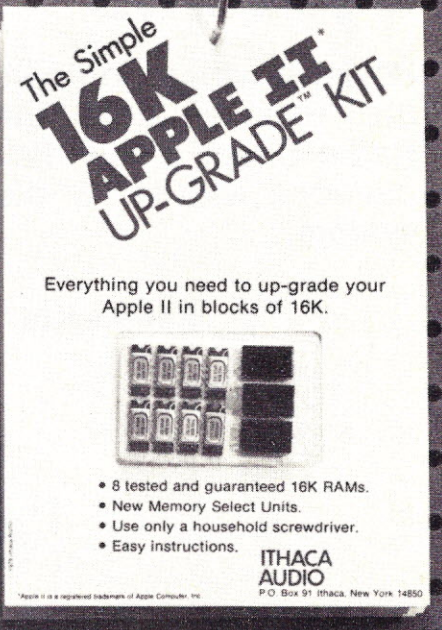
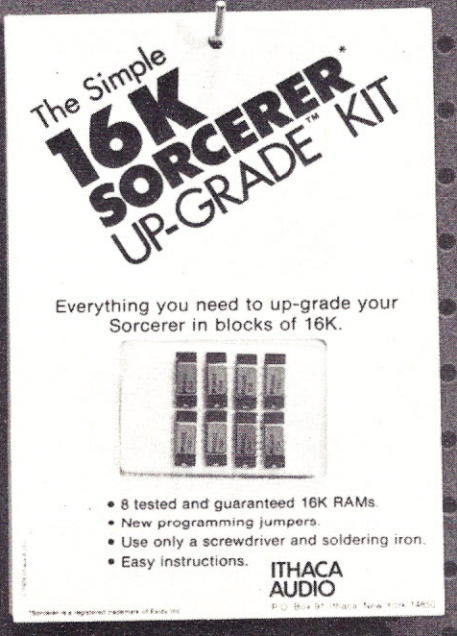


These Simple Up-Grades are Ithaca Audio's first step in adding more capability and reliability to your computer at lower cost. Other Up-Grades are on the way to your dealer now.

Receiving unprogrammed jumpers and having to program them yourself is not much better. Most important, that's the place where the problems are introduced.



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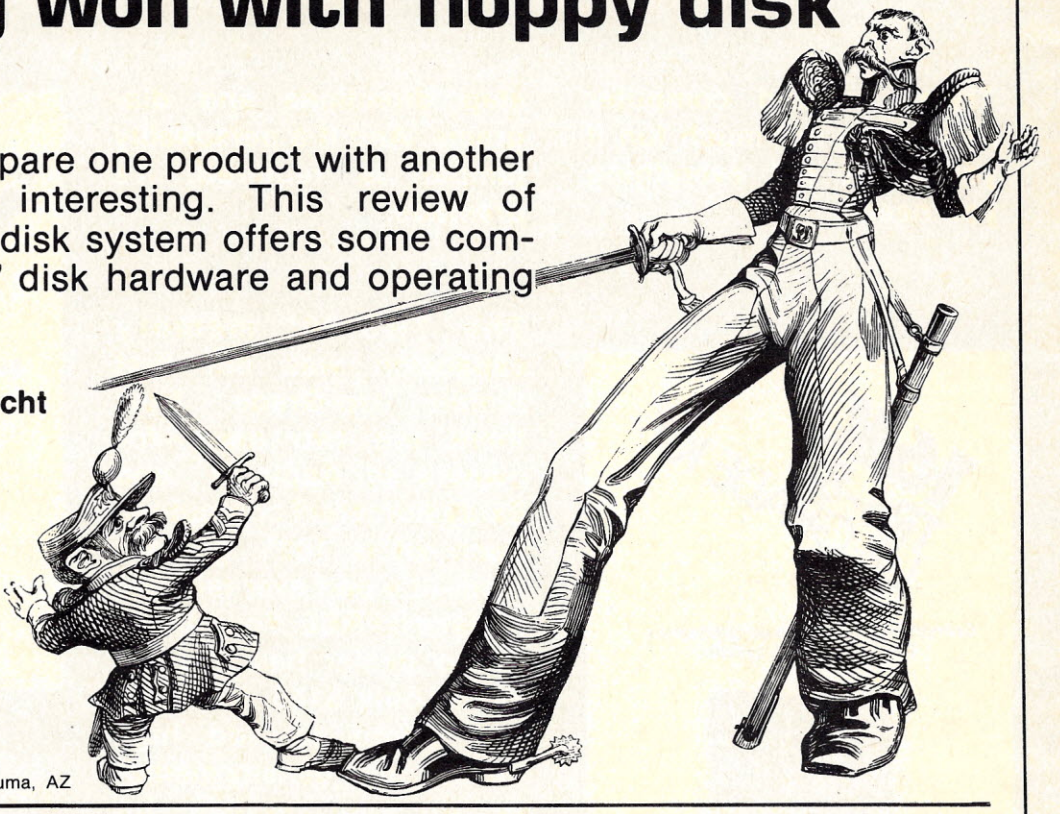
CIRCLE 109 ON READER SERVICE CARD

The Battle Against Slow TRS-80 Computing
It's being won with floppy disk systems

Reviews which compare one product with another are usually more interesting. This review of Radio Shack's new disk system offers some comparisons with MITS' disk hardware and operating system.



Ken Knecht

Ken Knecht, 1890 W. Colorado St., Yuma, AZ

I just got my first disk drive for my TRS-80 and I'm very happy with it. Ran perfectly ever since I unpacked it.

I'd been using Level II BASIC and was anxious to have the much faster saving and loading of programs with the disk, and since I write business programs for part of my livelihood I was anxious to try those I had written while waiting for the disk.

I've previously used MITS 4.0 disk BASIC and will first give a few comparisons. Incidentally, this is version 2.1 of the TRS-80 DOS (TRSDOS).

Comparisons

A random record is 128 bytes long in MITS, 255 in TRS. The maximum number of records that can be stored on a disk in MITS is 2046, 329 on a TRS disk (remember though, the TRS records are essentially twice as long). You can store 255 files on a MITS disk, 48 on a TRS disk.

It's obvious that the TRS-80 disk will hold much less data, roughly 1/3 as much. The total capacity of a MITS disk is 250K bytes, a TRS-80 55K or 85K bytes. We'll discuss this "or" later.

I'll have to admit I'd sure like more disk storage for some programs, for instance when I have to keep a very large data-base on line, but in most other programs I find I have more than enough room. For one program I find I'll need four drives, and would like to use one more, but TRSDOS will only handle 4 drives. Perhaps later on we'll have a dual density drive available, or full size floppies, or whatever, to choose from.

The disk drive runs much more quietly than does the MITS; no fan and the head loads very gently. You can't hear the motor run unless you listen for it. Also, the motor only runs when the drive is being used, not all the time.

Storage Capacity

I mentioned earlier that the total disk storage area was 55K or 85K bytes. Well, if the disk is in drive 0 it has 55K bytes of storage, in drives 1, 2 and 3 it has 85K bytes. The reason for this is the DOS system keeps most of its utility programs and the extensions to Level II BASIC on the disk until needed. Thus 30K of disk space is pre-empted by this software. This disk must be in drive 0 to use the system. I'm wondering if all the extensions to Level II BASIC might not run with a blank disk in drive 0 after disk BASIC is loaded. I can't try this until I get my second drive and can FORMAT a disk.

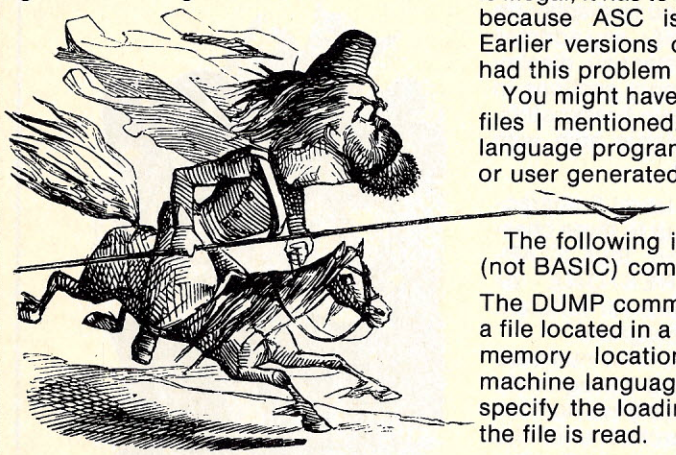
Now you are probably wondering if you are going to be stuck with only one usable disk if you only have one drive. No problem, you can copy this software onto another disk quickly and easily, thus making as many drive 0 disks as you wish. Yes, you can copy a disk even if you only have one drive!

I wish that the records were 128 bytes, as in MITS disk BASIC, instead of 255 bytes. Note 255, so you can't fit in two 128 byte records. This means I'll have to do a lot of rewriting to use my old MITS programs using random disk files on the TRS-80. Rats!

The Basic

However, the disk BASIC is very much like that of MITS, almost all BASIC commands are the same, with the TRS missing a few present in MITS disk BASIC, such as SWAP, RENUM, ERASE, WAIT and possibly a few more. The only one I really miss is RENUM, and that is available on tape as a System program. So if you are used to MITS BASIC you will find the changeover an easy one. I suspect it would be from most other BASICs as well, as the dialects aren't all that different. If you write your programs in modules to be loaded off disk as required, as I do, then you can generally use CLEAR to replace ERASE.

Two commands conspicuous by their absence in the TRS disk BASIC are MOUNT and UNLOAD. Nope, no equivalent either. Just put the disk in the drive and go, or pull it out when you wish. Of course, don't remove the disk if the LED on the drive door is on, indicating it is reading or writing. So much for MITS. On to the DOS. Now it gets interesting.



The Disk Operating System

The DOS is more like you'd expect a DOS to be. That is, like a micro version of a big computer's operating system. And that's what it is. BASIC is just one of the programs it calls. There are many other interesting programs and features as well.

The TRSDOS permits file protection — at three levels. You can protect a file to be available in any of the following categories, with or without a password.

Execute
Read, execute
Write, read, execute
Rename, write, read, execute
Total Access

You always have total access with your password. Of course if you forget the password you have problems. But each disk also has a password, allowing you to change the file passwords if you know the disk password.

Of course you can change the passwords and protection whenever you wish. You can also make a file invisible to a normal DIR (file name listing) if you wish. This DOS command is ATTRIB with the various options.

You can use the DOS command APPEND with the names of the two files to add one sequential file to the end of another. This is very useful to extend a sequential file without having to write a subroutine to re-record it.

Then there's the DOS DIR mentioned earlier. This is like FILES in MITS disk BASIC only more so.

DIR prints out all visible BASIC file names (remember the invisible files under protection?). If you add S (DIR : (S)) then it also displays System files. An I gets you all invisible and non-system files. An A gives you the disk allocation for the files displayed. So DIR : (S,I,A) gives you everything.

Notice two things, the disk drive number in all cases is optional and spaces, especially in DOS commands, are critical. Even in BASIC some are critical. For example, FIELD3,128ASC$ is illegal, it has to be FIELD3,128 AS C$ because ASC is a reserved word. Earlier versions of MITS disk BASIC had this problem too, but not 4.0.

You might have noticed the Systems files I mentioned. These are machine language program files, used by DOS or user generated.

The following is a list of more DOS (not BASIC) commands:

The DUMP command permits loading a file located in a consecutive series of memory locations, for example a machine language program. You also specify the loading address for when the file is read.

FRE lists the free disk space on all used drives in terms of files available and granules (1.25K bytes, or 1/2 track) by drive number.

LIB lists all available DOS commands in that version.

LOAD loads a machine language program file into memory. This is different than the disk BASIC LOAD.

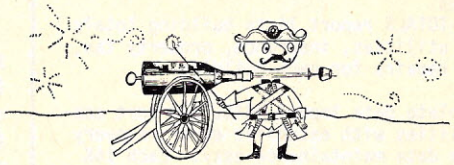
PROT changes file and disk passwords. It permits changing all the passwords to one, or to remove the passwords, or change the disk password (all only if you know the disk password).

RENAME permits changing a file name. This does not affect that file's password or protection.

VERIFY(ON) causes DOS to verify all BASIC disk write operations. That is, read them after they have been written to be sure they were recorded properly. The DOS system disk writes do this automatically. The default is VERIFY(OFF).

TAPEDISK is a DOS utility program which allows loading Radio Shack (and other?) System tapes into RAM, then into a file on disk. Programs must load after 54F4 hex in memory. Which eliminates most programs.

DISKDUMP/BAS is a BASIC program (run under BASIC, not DOS) which permits you to make a sector by sector examination of any specified user file. It prints out each sector in hex, then with corresponding ASCII code, if printable. This shows how data is stored on the disk. Educational.



CLOCK turns the clock and display on and off; it is displayed in the upper right corner of the CRT screen. The DOS commands to set the time and date are TIME and DATE. The clock and date can be read (and printed) under BASIC with RIGHT$(TIMES$,8) for the time and LEFT$(TIME$,8) for the date.

TRACE turns on or off a display next to the clock showing the program counter contents in hex. I haven't figured out a use for this yet. This is different than the BASIC TRACE command.

AUTO is another DOS routine. This forces the DOS to load any DOS program upon power on. This could be used to load BASIC automatically when you turn on the computer. It can't force a BASIC program load because BASIC hasn't been loaded yet. Only one argument allowed.

BACKUP is the DOS program used to copy disks. It will also copy itself, and can copy with only one drive. It automatically FORMATs (initializes) diskettes if this has not already been done. It will only copy to a disk with no data stored on it. Therefore you must bulk erase a disk before you copy to it. That makes it pretty difficult to erase a disk by mistake.

When BACKUP runs it tells you which track it's FORMATing as it does, then tells you as it reads and verifies each sector, then the copy routine begins. DOS tells you as it loads each track into RAM for a one drive BACKUP. It loads as much data from the disk as it has room for in RAM, then requests you to change disks, then puts the data into the same tracks on the blank disk, and so on. Runs pretty fast too, only a few minutes and disk changes for a single drive BACKUP. MITS takes 30 minutes for a two disk drive copy.

COPY records a file under a new name, retaining the old file under the old name. Passwords and protection remain the same.

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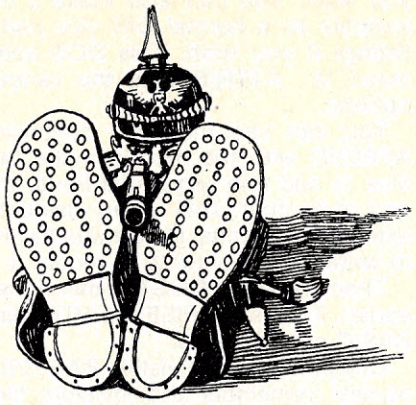
CIRCLE 144 ON READER SERVICE CARD



FORMAT initializes the disk. You can't FORMAT with only one drive, but if you only have one drive you need to use BACKUP to copy the 30K bytes of software you need to keep on the drive 0 disk anyway, so this is no loss. BACKUP does its own FORMAT. FORMAT takes less than a minute, not 7 minutes like MITS DOS.

The last program is a DEBUG, called by DOS. This is a pretty standard debugger; it permits you to display (in hex or ASCII), or modify, any address in memory, load a register pair, display registers, display memory sections in full screen, set up to two breakpoints, and single step or single step with CALLs completed.

File names are the usual 8 characters, but you can add up to three characters as an extension: thus STARTREK or STARTREK/ONE or STARTREK/#1, etc. Nice for different versions of the same program.

Another nice feature, drive numbers are optional. If you LOAD a program in DOS or BASIC without a drive number all drives will be searched until the program is found. Watch out for the same file name on several disks. Also, if you SAVE a program with no drive number specified it will be saved on the first disk found with enough room to hold the file.

Of course you can return to DOS from BASIC at any time. Just type CMD"S". To get to BASIC type BASIC to the DOS READY.

Disks are dated when they are initialized or copied. The date shows up when you use DIR.

Some Closing Thoughts

A few more interesting items I should mention. When you return to DOS from BASIC you lose the program you had stored in memory. A bit inconvenient at times as you always have to remember to SAVE a new program before you leave BASIC, even if only for a DIR. Of course this also means you can't use some of the more useful (to a program) DOS commands in a program like APPEND, FRE and RENAME.

Another thing you should note, the minimum length of a random or sequential file is one granule (1.25K bytes or 1/2 track). Thus one record random files are very wasteful, as are short sequential files.

When you FORMAT a disk you are notified of any bad tracks on the disk. These are locked out automatically. You are also given the option of locking out other tracks, and FORMATing or not these locked out tracks as well.

If you use the reset button on the computer you lose any program in RAM.

Power up is very easy, it's all automatic. Just put a DOS disk in drive 0 and turn the system on. I use a power strip to provide power for everything and use its on/off switch. The disk LED goes on for a few seconds and you get DOS READY before the monitor has warmed up. No loader programs to fool with or switches to flip or buttons to push.

You can also use your Level II BASIC and Systems tapes in two ways without going to the trouble of disconnecting the expansion module. Ask for BASIC2 instead of BASIC when you get DOS READY. Push the reset button on the computer to return to DOS. You can also get Level II BASIC when you power up if you hold down the BREAK key when you turn the computer on.

I'd recommend you purchase 16K of RAM in the expansion module for a total of 32K. With 10K of RAM used by DOS and disk BASIC the 6K left is not very much.

Incidentally, the DOS disk is free with the purchase of the disk drive; MITS charges an extra $200. Radio Shack gets $5.98 for additional blank disks, I can generally find them elsewhere at $3.50. ■

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CIRCLE 198 ON READER SERVICE CARD

the ORGANIZER

Channel Data Book

Lee Churchman

PET owners rejoice! Here's the ideal method for organizing the documentation on your system . . . and find out what you haven't been getting from Commodore!

Lee Churchman, 227 W. Cook St., Santa Maria, CA 93454.

The **Channel Data Book**, ($20 from Channel Data Systems, 5960 Mandarin Ave., Goleta, CA 93017) for owners of the Commodore PET, is really a very simple idea; an organized repository for all the bits and pieces of "things worth saving" we keep encountering but once saved, seem never to find again.

It is a large 3-ring binder with room for several hundred pages, and a set of dividers to help organize those pages. There are six attractively tabbed divisions: Commodore Communications, Hardware, Software, Information Sources, Address List . . . and Notes and References.

Some of the sections start out containing quite a bit. For example, the Commodore Communications section showed me just what Commodore *hasn't* sent me, and it's worse than I thought. That alone is worth the $20 price of the Channel Data Book, as well as an angry letter to Commodore. Pet owners who have suffered under Commodore's secrecy syndrome *really* need this book!

The hardware section has what seems to be a very complete list of things that can be connected to the Pet. It doesn't include the most expensive, which are properly considered to be out of the personal computing price class, but it seems to include everything else, and that's plenty! I was pleased to see a reformatted version of the IEEE-488 device list that Commodore was supposed to have sent me but never did. If you need help in connecting your Pet to any of the devices on this list, Channel Data Systems, the producers of the book, say they can help you.

The software section of this useful book accounts for the largest number of pages. I counted fifty-five, and most of the pages list a dozen or more programs available on cassette tape. That adds up to a whale of a lot of programs. It also adds up to a very useful list. I found several programs I intend to get, in categories where I thought nothing was available, and from firms I hadn't known existed. That has to be a significant value of the book!

Just as valuable, if not more so, is the list of information sources. Pet owners need information sources, since Commodore left a vacuum there. This section lists magazines, manuals, newsletters, schematics and workbooks. The list of newsletters may be the most useful part of this section to anyone who wants to do more with the Pet than play a pre-recorded cassette, but who doesn't want to re-invent the wheel each time a block on a flowchart is to be turned into lines of Basic.

Wisely, the previous sections of the book have not listed the address and phone number for each name. To do so would involve a lot of repetition and not generate a very useful look-up table. The last section is just such a table. If you want the address of the Pet Users of Japan, the Pet dealer in Dallas, TX, or the name of the man to talk to at the Lawrence Hall of Science Computer Project, it's all there, and all easy to find.

Things change, of course, and in the field of microcomputers they change rapidly. The publishers plan a major annual update of the Channel Data Book, to be published in the first quarter of each year, with supplements at least quarterly. For the initial purchase price of $20 you get the book and the update service for one year.

The book is valuable just as it comes from Channel Data Systems. It will assume its true value, however, only as you fill it with the pages that mean something to *you*. Each of us has his or her own needs; I will populate my book with listings for valuable subroutines, articles from magazines, ideas for things to do (some distant day when I have time) and all the variety of things I want but haven't been able to keep track of before. ■

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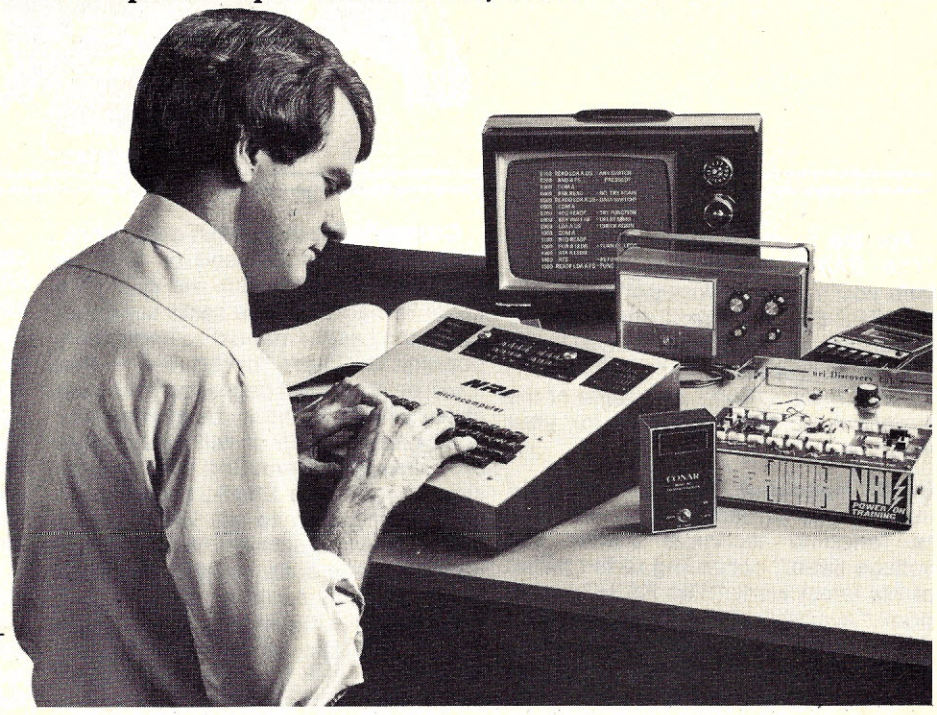

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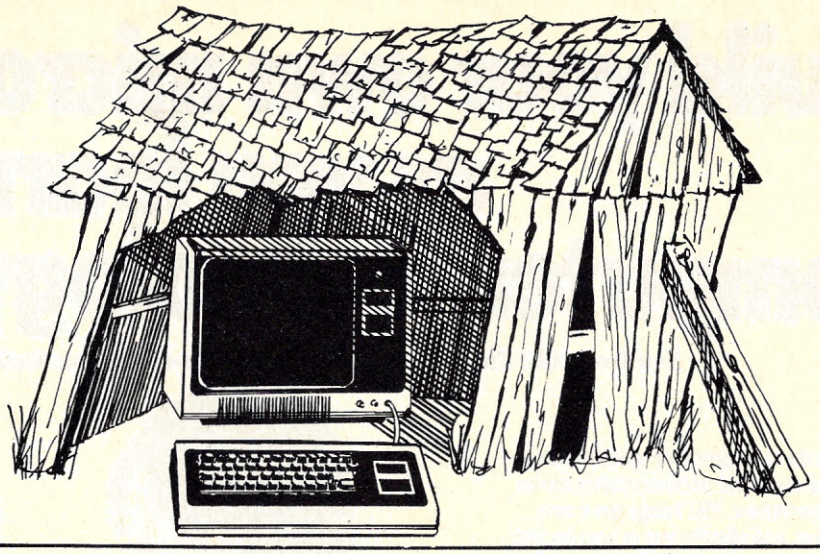
175-039

TRS-80 Strings

Stephen B. Gray



For the fourth column, let's look at "The BASIC Handbook," which will help you translate "foreign" programs into TRS-80 language; a dual-cassette switchbox to help you CLOAD and CSAVE; a new edition of the "Guide to TRS-80 Information;" and some of the suppliers of 16K memories for your machine.

BASIC Handbook. The TRS-80 Level-I manual was written by Dr. David Lien, "a longtime technical author and college dean," according to the jacket of his latest work, "The BASIC Handbook," available at $14.95 plus $1.35 for P&H, from CompuSoft Publishing, 8662 Dent Drive, San Diego, CA 92119.

This encyclopedia explains over 250 BASIC statements, functions, operators and commands, from over 50 of the most-used dialects. Nearly all the TRS-80 words are here.

For each word you get a description, a test program and sample run using the word, helpful hints (if needed), variations, and other information. The best part of the book is the section, provided with some of the words, called "If your computer does not have it," which gives "alternate ways to accomplish the same objective using other BASIC words, when possible ... and it isn't always possible."

This is exactly the book you need if you're trying to convert programs that use words not available in the TRS-80 instruction set, such as MAT READ, DSP or SLEEP, into Level-I or Level-II programs. This is the *only* book I know of that will show you how. And it is beautifully written: clearly, concisely and thoroughly.

The only disk statements are the few mentioned in passing in the # pages. Even without the disk words, the book was targeted at 280 pages, and wound up at 360. Had the disk words been included, the handbook could have cost $20 to $25, Dr. Lien says.

CompuSoft may publish a disk book, perhaps around the end of 1979, or early 1980. CompuSoft *will* publish a Level-II manual in the same style that made the Level-I manual so immensely popular. Dr. Lien's "best guess" is that it will be about 300 pages long and cost about $14.95, and may be available by late spring of 1979. It will be available only through CompuSoft or computer stores, not Radio Shack. Please don't write CompuSoft to ask when any of their future manuals will be available; if they take time out to reply, publication of the manuals could be delayed.

Incidentally, the manual that Dr. Lien wrote for Radio Shack, titled "User's Manual for Level 1," with silver printing on a black cover, is still being packaged with every Level-I TRS-80. For sale as a separate $5.95 book in Radio Shack stores, the title has been changed to "BASIC Computer Language" and a very different cover is used, featuring a photo of Peter Nero, musician and TRS-80 user.

The RF-II dual-cassette switchbox, from Fuller Electronics, eliminates having to plug and unplug cables when you CLOAD or CSAVE, and facilitates copying data (or audio) tapes.

Switchbox. If you CSAVE any of your TRS-80 programs, you know the problems of having to plug and unplug cassette cables. Some of this can be eliminated by following the instructions in the Level-II manual:

"To REWIND or FAST-Forward a cassette, place Recorder in REWIND or FAST-Forward, then type CLOAD and hit ENTER. When the tape has reached the desired position, push the Reset button inside the Expansion Port access door (rear left of the TRS-80). (Instead of using the CLOAD/Reset sequence, you could remove the REMote plug from its jack; however, repeated insertion/removal tends to wear out any plug and is not recommended.)"

That takes care of one problem, but if you want to listen to the source tape to know when the "bit stream" starts flowing, you've got two choices: remove the EARphone plug, which ruins the recording; or put an AM radio near the keyboard.

A neat solution to all these problems is Dick Fuller's RF-II switchbox. It's about the size of 1½ TRS-80 power supplies, is a close match to the TRS-80 design, and sits atop your recorder.

The computer cables plug into the RF-II, and the RF-II has cables for plugging into one or two cassette recorders. The RF-II also contains a computer/recorder switch that puts the recorder(s) under computer control or which yields control to the recorder(s), a both/off/cross switch used only if a second recorder is connected, LEDs that indicate computer and recorder status, and an internal speaker.

With the RF-II switchbox, you can:

- Monitor CLOAD and CSAVE through the internal speaker,
- Monitor fast forward or rewind, if your cassette recorder is the Radio Shack CTR-41 or similar,
- Adjust monitor volume without affecting data volume,
- CSAVE with two cassette recorders simultaneously.
- CLOAD with either of two recorders without pulling cables,
- Cross-tape (copy tape) from

recorder one to recorder two, or vice versa.

After you've used RF-II awhile, you'll wonder how you got along without it. You may have seen construction articles for a similar "cassette interface switching box" in other publications, but with this kit, you don't have to go looking for parts.

The RF-II, from Fuller Electronics, 7465 Hollister, Suite 232, Goleta, CA 93017, is $34.95 in kit form, $49.95 assembled, plus $2 postage (CA residents add 6% tax).

The price would be lower if Dick Fuller had used cheaper parts, but to make it easier for people who destroy parts during construction or use of the RF-II, nearly all parts are Radio Shack parts and are available nationwide. Dick Fuller, incidentally, was the first editor of CLOAD magazine, and his voice is on the audio portions of all the early issues, when they were still using voice. Dick is now devoting full time to the RF-II and to some other goodies we'll talk about when they're ready.

The RF-II kit "is not recommended for the first-time kit builder," as the instructions say, and I agree, after six hours of cramming a lot of components into a small box. For $15, let Dick's crew do the hard work. If you think you can put it together, but "after reviewing the instructions you feel you would prefer an assembled version, return the kit, unassembled, with $15 and we will send you an assembled RF-II. Remember, you may return the kit for a full refund, if you so desire." What could be fairer?

The only problem I had with the RF-II was the instructions' comment that for cross-taping, "the level control on the recorder that is in the play mode should be about 2." At that level, I got no flashing asterisk at all, not until I raised the volume to 4 or 5.

After duplicating several data tapes, I wondered if the RF-II could be used to copy audio tapes, since I have a collection of folk music on cassette. But when I tried it, there was a bad hum on the copied tape. Thought it might be AC-line hum, so ran both recorders on batteries (four C-size in each), and the hum was gone. Very easy to copy tapes now.

Although the instructions for cross-taping data recommend that you use batteries only, and remove the cassette DIN plug from the computer, I did neither of these and had no trouble when cross-taping *data* only.

The battery, incidentally, is used only to power the green LED, which is not essential to the operation of the RF-II. If you have a "battery card," free 9-volt batteries (or other sizes) can be obtained at your Radio Shack dealer, one battery a month for a year.

Guide to TRS-80 Information. The first edition was reviewed here (Nov/Dec 1978, p 36) as "a must for any really serious TRS-80 nut," but is not easy to read because of poor typing and/or printing.

The publisher, acting on comments such as these, "went out on a limb and obtained an IBM Selectric ... and begged the printer to do the best job he could." The second edition is now much easier to read, packs twice as much information into a reduced format (now 8½ by 5½ inches) and costs only a little more: $3.30 including P&H, from F.E. Heubner, Box 37206, Oak Park, MI 48237.

Converting to 16K. There are many ways to bring your 4K TRS-80 up to 16K. Here are only a few, as taken from the ads:

- **Radio Shack**: 16K memory, installed at no extra installation cost. $290.
- **Advanced Computer Products** (Box 17329, Irvine, CA 92713): 16K memory with jumpers and instructions

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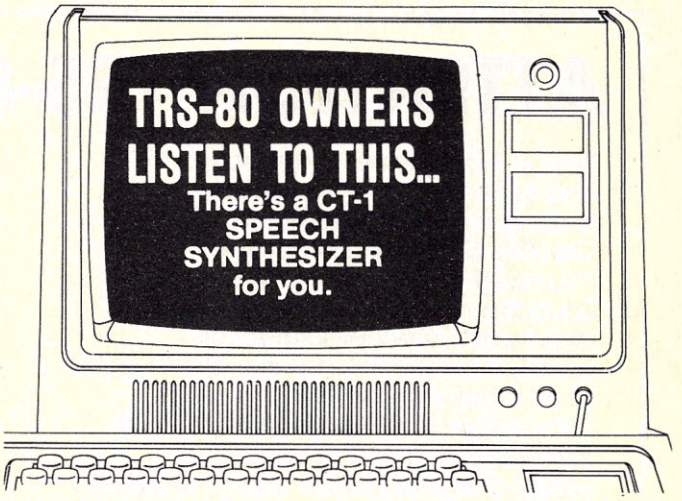

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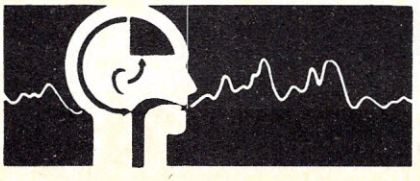

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(specify Level-I or Level-II), $119.95.

• **Deltronics** (Box 29363, Atlanta, GA 30359): Eight 250nS dynamic RAM chips, 2 plug-in DIP shuts, complete set of instructions; 16K RAM package, $129.95; 32K RAM package, $238.50.

• **Digital Micro Systems** (Box 1212, Orem, UT 84057): 16K RAM expansion kit $125 with free software. Or we can install it for you for $35 w/shipping.

• **Bill Godbout Electronics** (Box 2355, Oakland Airport, CA 94614): Upgrades TRS-80 mainframe from 4K to 16K, or populates Memory Expansion Module. 1-year warranty. $159. 3 kits $450.

• **Ithaca Audio** (Box 91, Ithaca, NY 14850): 8 prime dynamic RAMs and complete set of pre-programmed jumpers. Lifetime guarantee. $140.

• **Jade** (4901 W. Rosecrans, Hawthorne, CA 90250): 4116 dynamic RAMs, jumpers, instructions. $98.

• **Jameco Electronics** (1021 Howard Ave., San Carlos, CA 94070): 8 each UPD416 (16K dynamic RAM), $115. 16K conversion kit plus Sup 'R' MOD II (RF modulator tuned to UHF channel 33), $139.95.

• **MicroComputer World** (P.O. Box 242, San Dimas, CA 91773): 8 memory chips, jumper blocks, instructions. $79.

• **ABS Software/Hardware Specialists** (P.O. Box 8297, Ann Arbor, MI 48107): 8 MOSTEK chips, instructions, lifetime guarantee. $89.

• **MicroComputer Systems** (144 S. Dale Mabry Hwy., Tampa, FL 33609): 16K memory upgrade kits, TI prime industrial quality ICs, (TMS 4116-30JH). $125.

• **F. Reichert Sales** (1110 E. Garvey Ave., W. Covina, CA 91790): Install 16K memory. Send your TRS-80 microcomputer. 16K of memory and labor, $189. For 16K of memory, parts and installation data [you install], $159. [All factory seals must be intact. Any unit whose seals have been tampered with will be shipped back immediately.] Locations in Los Angeles, Portland, Denver.

• **UHF Associates** (90 Transport Ave #4, Rohnert Park, CA 94928): 16K Memory Retrofit. ICs plus instructions $95. Prime ITT 4116 ICs, 200nS. UHF installs $115.

• **West Side Electronics** (Box 636, Chatsworth, CA 91311): Includes 8 MK4116 RAMs and instructions, $130.

By the time you read this, some of these prices may have dropped, although Radio Shack has said they won't lower theirs. Note that if you open your TRS-80 to install additional RAM, you void the Radio Shack warranty.

Reichert offers six modifications, all requiring that you send in your TRS-80:

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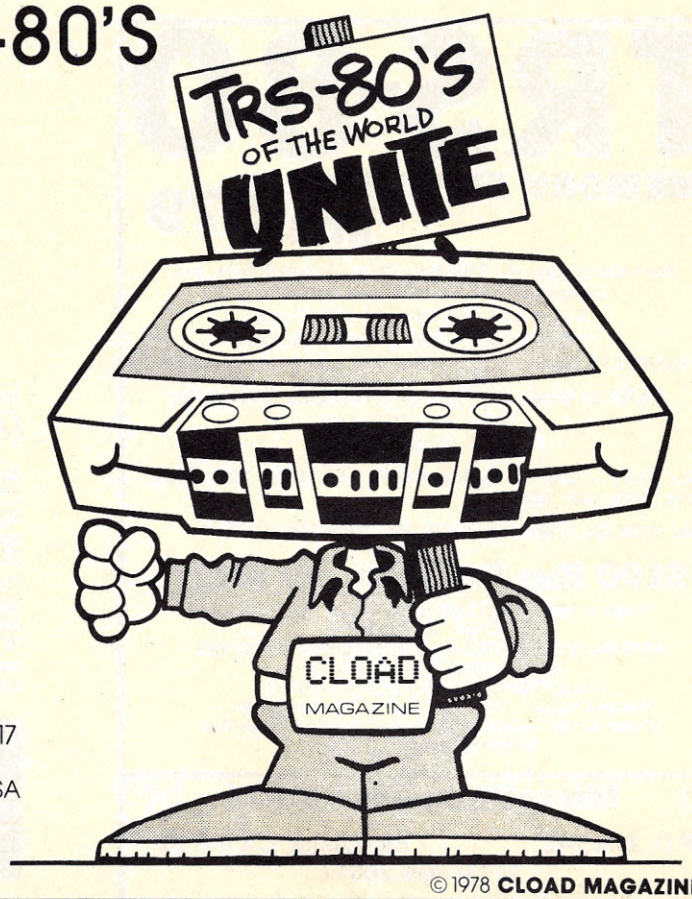

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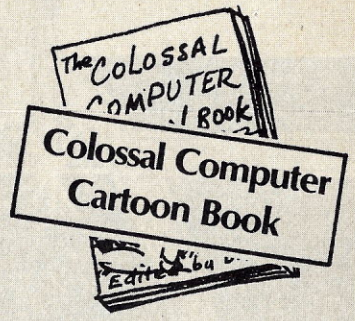

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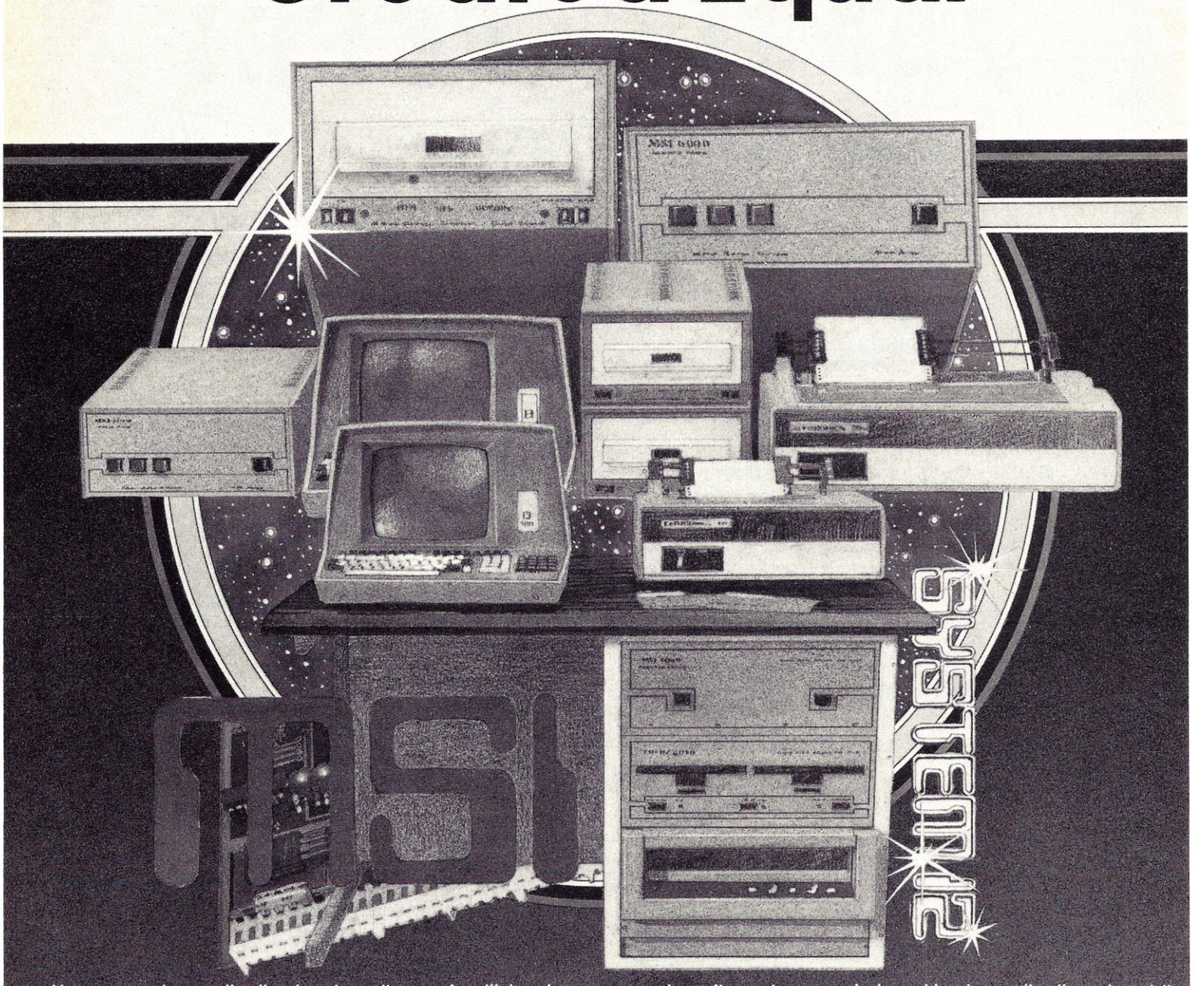

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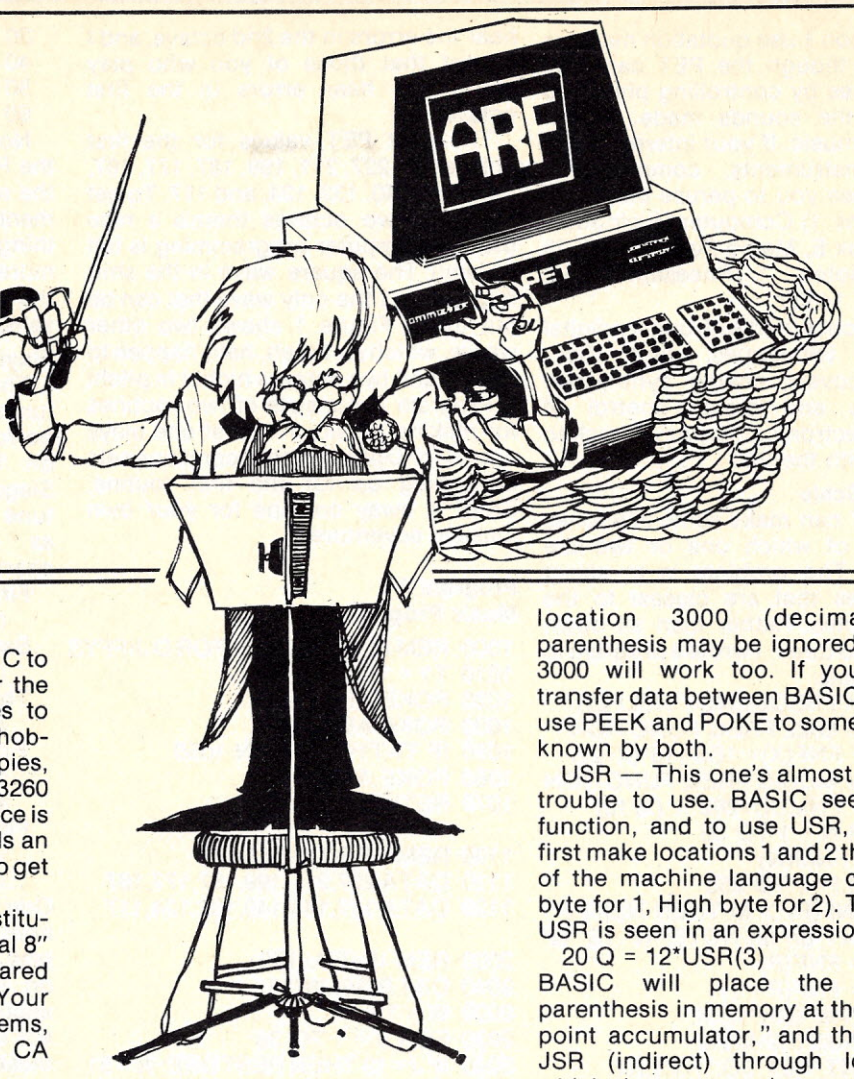

Disco Fever

Those of you waiting for the big C to provide a floppy disc system for the PET now have some alternatives to look at. If you are an individual hobbyist with an interest in minifloppies, drop a line to: Computhink, 3260 Alpine Rd., Palo Alto, CA. Their price is around $1300, and your PET needs an Expandapet for this system. You do get two floppy drives with this one.

If you are with a company or institution, there is a very interesting dual 8" floppy system which can be shared among several (up to 15) PETs. Your contact for this one is: Nestar Systems, 810 Garland Drive, Palo Alto, CA 94303.

Both of these are in the production prototype stage as I write this (Late November 78), and should be delivering when you read this. If you are comparison shopping, the PET Gazette and the XXX Paper have mentioned some other disc systems produced on the East coast.

Machine Language Machinations

After discussing the matter at length with John Craig (our noble Editor), I have decided not to do a great deal with 6502 machine language in this column. However the 10% of you who like assembly coding do have loud voices and I can be of some help — novices, skip on to the music section!

If you want to learn "how to" a good bibliography is on Page 97 of the Nov-Dec issue of Creative Computing. The PET Paper is planning a series of articles for the beginner in machine language for this year.

The PET has these facilities for making life with the wild coder at least livable:

PEEK — This is a BASIC function that returns the value of the byte specified in decimal. For example, PEEK (1024) returns Ø which is the value in address 1024 (or 400 in hex).

POKE — This BASIC statement writes the value of its second argument into the address provided by the first. (I hate to say this, but sometimes putting things in plain English is a circumloquatious pain...) For example, POKE 1000,123 will make the byte at 1000 have the value 123 — all in decimal, of course! POKEing in the wrong places will crash the PET, particularly if you POKE into the base page (0 - 255). Any address below 1024 is sacred to the PET.

Bugs have their esthetic side, and so do crashes. A really nice one can be done by entering these two commands. Wait a short while between them:

```
POKE 1026,3
LIST
```

Try it several times — the PET will vary in its response!

SYS — Here, BASIC will jump to the address mentioned, and run the machine language found there. When an RTS (Return from Subroutine) is encountered, control resumes in BASIC at the next statement. For example, SYS (3000) will start at location 3000 (decimal). The parenthesis may be ignored, i.e., SYS 3000 will work too. If you want to transfer data between BASIC and SYS, use PEEK and POKE to some locations known by both.

USR — This one's almost too much trouble to use. BASIC sees it as a function, and to use USR, you must first make locations 1 and 2 the address of the machine language code (Low byte for 1, High byte for 2). Then when USR is seen in an expression, i.e., like

```
20 Q = 12*USR(3)
```

BASIC will place the value in parenthesis in memory at the "floating point accumulator," and then does a JSR (indirect) through location 1 which leaves you in your machine code. To get back RTS will suffice.

The floating point accumulator consists of 5 bytes starting at BØ hexadecimal (176 decimal), and is in the following format:

BØ	Binary Exponent + 8Ø (128 decimal)
B1 - B4	Mantissa (normalized)
B5	Sign - Ø if mantissa is Ø + if mantissa + (i.e., 128 or more in decimal) - if mantissa is -

Normalization means that the MSB of B1 will always be 1 and the exponent adjusted accordingly.

If your machine code changes these bytes, when USR returns, BASIC will use the new value as USR's value.

As I said, USR is lots of trouble to use, and this is enough on machine language at present. Good luck to you, and check the bibliography that was mentioned.

Music At Last

If you read the preceding column, the PET can be made to generate tones and sounds by the CB2 line in the User Port. Now let's go on to doing "musical" things.

The reason I use quotation marks is that even though the PET can play simple tunes by controlling pitch and duration, the sounds made do not qualify as music. If your interest lies in making instruments, compositions, etc., I advise you to peruse these two publications: 1) Computer Music Journal, PO Box E, Menlo Park, CA 94025 2) Electronotes, 1 Pheasant Lane, Ithaca, NY 14850.

CMJ is concerned with quality digital synthesis techniques, and Electronotes covers analog synthesizer techniques and digital control of musical electronics. Anyways, back to diddling with the PET.....

Making a Scale

The PET can make some 255 tones with CB2 of which one or two are inaudible. The problem is to select those tones that are closest to the musical notes. Rather than sit down with a piano tuner, I wrote a program to find my notes:

```
 10 REM FREQUENCY HELPER
 20 REM 6522 FREQ FUNCTION
 30 DEF FNF(X)= 1E6/(16*(X+2))
 40 REM MUSIC FREQ FUNCTION
 50 DEF FNM(X)=262*↑ (X/12)
 60 FOR N = 1 TO 36
 70 M = FNM(N)
 80 FOR P=1 TO 255
 90 IF FNF(P) > M THEN NEXT P
100 PRINT"dn dn NOTE:"N" 1S "M"
110 P1 = FNF(P)
120 P2 = FNF(P - 1)
130 R1=100*(M-P1)/M
140 R2=100*(P2-M)/M
150 PRINT"PET LO:"P;P1;R1
160 PRINT"PET HI:"P-1,P2,R2
170 GET A$:IFA$="" THEN 170
180 NEXT N
```

The function in Line 30 computes the frequency that a square wave in the shift register will be made by the PET when the number X is POKEd into the timer at 59464. For example, the sequence

POKE 59467,16: POKE 59466,15: POKE 59464,100

will make a tone of 612.7451 hz. Line 50 computes the even tempered frequency for the note X, starting at middle C, 262 Hz as note # 1.

The program then starts with note N=1 and searches through the possible values to POKE until a frequency less than the musical note is found. Then the PET prints the POKE values just above and just below the musical note along with the % error in frequency. Line 170 provides a pause while I write the best POKE value down.

The pitch error gets worse as the notes get higher, as the PET's selection of frequencies is sparser and sparser. The first octave had errors around .2 to .3%, the second around .4 to .6% and the third was even worse. (Find out by running the program!) My ear could hear the errors in the 2nd octave, and I expect that those of you who play music will hear errors in the first octave.

The best PET values for the first octave are: 227, 211, 199, 187, 177, 167, 157, 148, 140, 132, 124, and 117. To get the next two octaves there's a nice trick!!! (Computer programming is full of 'em!) The square wave in the shift register isn't the only wave that can be put there. Figure 1 shows two other waves, which *just* (heh, heh) happen to be one and two octaves higher in pitch!

Program A consists of two routines for making music. The first one plays note N for D jiffies. The second one sets everything up for the first routine. SAVE it away on tape for your own musical adventures.

Program A
Music Program

```
1000 REM PLAY NOTE N FOR D JIFFYS
1010 T1 = TI
1020 POKE AF,P(N)
1030 POKE AW,W(N)
1050 IF TI-T1< D THEN 1050
1060 POKE AW,0
1070 RETURN

1100 REM FREQ DATA
1110 DATA 227,211,199,187,177,167
1120 DATA 157,148,140,132,124,117

2000 REM INITIALIZE
2010 DIM P(36),W(36)
2020 W = 15
2030 FOR J = 1 TO 36
2040 IF J = 13 THEN RESTORE: W = 51
2050 IF J = 25 THEN RESTORE: W = 85
2060 READ P(J): W(J) = W: NEXT J
2070 AW = 59466: AF = 59464
2080 POKE 59467, 16
2090 RETURN
```

The play routine, 1000, takes note of the time as T1 (Letter T, digit one) and pokes the frequency (timer 2) location AF to the value in the frequency array P(). Then it pokes a wave from the wave array W() into the wave (shift register) AW. The loop at 1050 waits for D jiffys, and then a zero is put into AW to turn the sound off.

The initialize routine, 2000, sets up the arrays P() and W(). P() holds the 12 frequencies, repeated 3 times, and W() holds the three waves in sets of 12. This lets the play routine cover a 3 octave range with reasonable pitch fidelity.

To see how well this performs, add the following lines. BE SURE TO SAVE IT FIRST!! RUNNING MUSIC PROGRAMS MAKES THE PET FORGET HOW TO SAVE TAPES CORRECTLY. If you have goofed, you can recover by entering: POKE 59466,0: POKE 59467,0: POKE 59468,12.

```
 10 GOSUB 2000:D=20
 20 GET A$; IF A$="" THEN 20
 30 N=ASC(A$)-64
 40 IF N>36 OR N<1 THEN 20
 50 GOSUB 1000
 60 GOTO 20
```

Now when you press a letter (A to Z) the PET will play a note, and you have the world's clumsiest keyboard instrument! Those of you who like such things can make the PET keyboard more like a piano or organ. (Hint: Scan the string ASDFGHJKL by MID$ to select N, the note number.)

Playing Tunes

The next thing to tackle is playing tunes. The following scheme is borrowed from the article "Scott Joplin on Your Sci-Fi Hi-Fi" by Dorothy Siegel, ROM, October 77, page 61. The tune is stored as a set of DATA strings as follows. Each string has 4 characters:

- First Character: This is the note name, A,B,C,D,E,F or G
- Second Character: Sharp (#), Flat (!), or Natural (sp).
- Third Character: Octave, with 1 being the lowest, 3 the highest.
- Fourth Character: Duration S,E,Q,H, or W — Sixteenth thru Whole notes.
- Fifth Character (optional): "." will increase duration by ½ the amount in the 4th character.

One improvement has been made. The note name R means a Rest, and will play note # 0 — which will be a silence on the PET. If you make an error encoding the DATA strings, the PET will ignore the note. You can add error messages if you like.

Figure 2 has the listing. Note that the song DATA must come after the notes data, and that much use is made of scanning strings by a loop and the MID$ function. The DATA statements have the tune "The Entertainer" by Scott Joplin for your pleasure.

I don't have enough space to explain the music player in detail (sorry 'bout that!). Take note of the string in Line 260 — this is an easy way of skipping counts when scanning, in this case, the positions of the musical notes. Lines 330 and 340 have some trickery to switch from the musical scale to the pet note number.

If you code your own tunes, I'd like to hear a copy — I will return any cassettes that you send.

Random Music

There isn't any reason why the pet can't be a composer too ... though what you hear might not be oriented towards humans. The RND function provides several possibilities which sound quite different to the ear:

1) "White" Music — Here the notes are chosen with equal chances over the scale (0 to 37 for the PET). The duration is also made random in the same manner.

2) "Brown" Music — Each note is chosen by adding or subtracting a small number from the preceding note — for example, choosing from -2,-1,0,+1,+2 at random and adding.
3) "Fractal" Music — This is "between" White and Brown Music. For a detailed description, see Scientific American, April 78, Mathematical Games dept.

White Music tends to be too "random" and chaotic — the changes are abrupt, and there is no relation to past notes. Brown Music is too dull, with each note only varying a little from its predecessor. Fractal is "in between" and is more interesting than White or Brown.

To try these out, LOAD the music routines (Program A) and add some code. For White Music, add:

```
 10 GOSUB 2000
100 N=37*RND(1)
110 D=15
120 GOSUB 1000
130 GET A$: IF A$="" THEN 100
140 END
```

Line 100 selects a note from 0 (rest) to 36. Line 130 provides a way to stop the music. See if you can change Line 110 to provide random durations as well. Again, SAVE before playing!!

Brown Music goes like this:

```
 10 GOSUB 2000
 20 GOTO 200 (To skip White Music)
200 N=18
210 IF RND(1)>.5 THEN N=N+1: GOTO 230
220 N=N-1
230 IF N<0 THEN N=0
240 IF N>36 THEN N=36
250 D = 15
260 GOSUB 1000
270 GET A$: IF A$="" THEN 210
280 END
```

Line 210 flips a coin, and if "heads" (i.e., more than .5), the note rises. If "tails" the note falls. Lines 230 and 240 provide top and bottom limits. An interesting variation is to permit larger ranges, say, +2,+1,0,-1,-2 for each note. A range of 10 notes sounds more like White music for the 36 notes the PET can play.

Making Fractal Music is more complex. Take several dice (say 3) and label them A, B and C. Then using the following table,

A	B	C
0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

First throw all three die and add the numbers. This is the first Fractal number. Then, take the first entry in the table (000) and throw the dice that are indicated with 1's — that's no dice the first time, Dice C the second time, etc. Each time, add the dice to get the fractal number. When the table is finished, start at the top and continue.

For the notes 0 to 37, I chose 4 dice with 10 sides each, with the numbers 0 to 9 on them — this gives sums from 0 to 36. Here's the code:

```
 10 GOSUB 2000
 20 GOTO 300 (skip the others)
300 D1=10*RND(1)
310 D2=10*RND(1)
320 D3=10*RND(1)
330 D4=10*RND(1)
340 C=0 : D=17
350 IF C AND 1 THEN D1=10*RND(1)
360 IF C AND 2 THEN D2=10*RND(1)
370 IF C AND 4 THEN D3=10*RND(1)
380 IF C AND 8 THEN D4=10*RND(1)
390 C = C+1 AND 255
400 N=D1+D2+D3+D4
410 GOSUB 1000
420 GET A$: IF A$="" THEN 350
430 END
```

Lines 300 to 330 throw the dice the first time. Lines 350 to 380 select the dice to throw according to the number C by checking the appropriate bit via AND. Line 390 counts up one and limits C to 255 (though it would take awhile to play 32000 notes!) Line 400 adds up the dice for the note.

If "smoother" music is wanted, 9 dice with 5 sides each can be used — that's up to you. The "smoothest possible" would be 36 binary dice — a project for machine coders.

If you entered the code for all three kinds of music, why not provide the user with a choice by asking what he wants and playing until he presses a key? (That's why the line numbers are set to not collide with one another.)

Transitional Music

Pure random music gets dull rather quickly — another method is to limit the choices that each note can take. For example,

NOTE	Next Note Choices
1	2,3
2	3,4
3	4,5
4	5
5	1

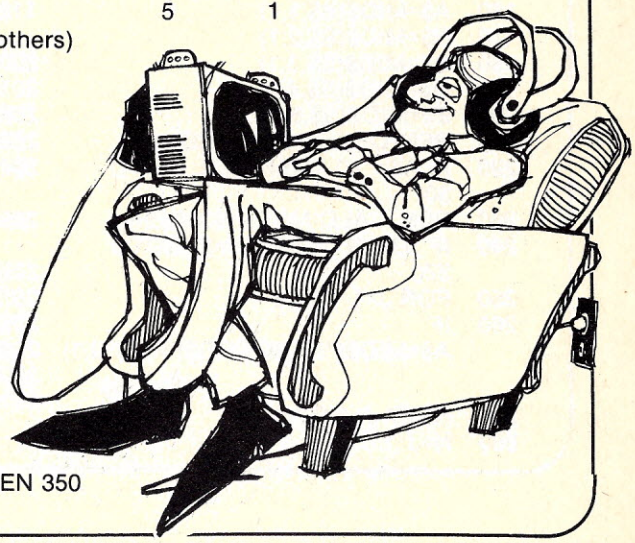

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Figure 2

Subroutine 1000 has been modified to play the note while the next one is being computed. The rest in Line 5000 permits correct completion of the last note.

SCOTT JOPLIN MUSIC PLAYER

```
 10 REM MUSIC PLAYER
 20 REM SCHEME FROM 'SCOTT
    JOPLIN'
 30 REM ARTICLE, ROM, OCT 77
    PG 61
 40 REM CODED BY GREGORY
    YOB FOR PET
 50 GOSUB 2000
 60 REM READ TEMPO & CON-
    VERT TO JIFFYS
 70 READ TM
 80 BT = 3600/TM
 90 REM INTERVAL FUNCTION
100 DEF FNI(X)=INT(BT/X+.5)
110 PRINT "PRESS ANY KEY TO
    PLAY"
200 GET A$: IFA$=""THEN 120
130 REM READ STRING &
    DECOMPOSE
140 READ S$
150 S$=S$+" sp sp sp sp sp"
160 A$=MID$(S$,1,1)
170 B$=MID$(S$,2,1)
180 C$=MID$(S$,3,1)
190 D$=MID$(S$,4,1)
200 E$=MID$(S$,5,1)
210 REM CHECK FOR END
220 IF A$="X" THEN CLR; GOTO
    50
230 REM CALC NOTE NUMBER
240 IF A$="R" THEN N=Ø: GOTO
    370
250 FOR J=1 TO 12
260 IF
    A$=MID$("AABCCDDEFFGG"J,1)
                    THEN 280
270 NEXT J: GOTO 140
280 N=J
290 REM SHARP OR FLAT
300 IF B$="#" THEN N=N+1
310 IF B$="!" THEN N=N-1
320 REM OCTAVE & FINAL
    FIDDLING
330 Q=ASC(C$)-48 AND 7
340 N=N-15+12*Q
350 IF N<1 OR N>36 THEN 140
360 REM FIGURE DURATION
370 FOR J=1 TO 5
380 IF D$=MID$("WHQES",J,1)
    THEN 400
390 NEXT J: GOTO 140
400 D=FNI(2↑(J-1))
410 IF E$="." THEN D=1.5*D
420 REM PLAY NOTE!!
430 GOSUB 1000: GOTO 140
1000 REM PLAY NOTE N FOR D
     JIFFYS
1010 REM **** T1=TI
1020 POKE AF,P(N)
1030 POKE AW,W(N)
1050 IF TI-T1<D THEN 1050
1060 T1 =TI
1070 RETURN
1100 REM FREQ DATA
1110 DATA 227,211,199,187,177,
     167
1120 DATA 157,148,140,132,124,
     117
2000 REM INITIALIZE
2010 DIM P(36),W(36)
2020 W=15
2030 FOR J=1 TO 36
2040 IF J=13 THEN RESTORE:
     W=51
2050 IF J=25 THEN RESTORE:
     W=85
2060 READ P(J):W(J)=W:NEXT J
2070 AW=59466: AF=59464
2080 POKE 59467,16
2090 RETURN
3000 REM SONG DATA
3010 REM TEMPO IN BEATS/
     MINUTE
3020 DATA 80
3030 REM SONG NOTES
3040 DATA D 3S,E 3S,C 3S,A 3E,B
     3S,G 2E
3050 DATA D 2S,E 2S,C 2S,A 2E,B
     2S,A 2S
3060 DATA A!2S,G 1Q,G 3E,D
     1S,D#1S
3070 DATA E 1S,C 2E,E 1S,C 2E,E
     1S,C 2Q
3080 DATA C 3S,D 3S,D#3S
3090 DATA E 3S,C 3S,D 3S,E 3E
3100 DATA B 3S,D 3E,D 3Q,D
     1S,D#1S
3110 DATA E 1S,C 2E,E 1S,C 2E,E
     1S,C 2Q
3120 DATA C 2S,A 3S,G 2S
3130 DATA F#2S,A 3S,C 3S,E 3E,D
     3S,C 3S
3140 DATA A 3S,D 3Q,D 1S,D#1S
3150 DATA E 1S,C 2E,E 1S,C 2E,E
     1S,C 2Q
3160 DATA C 3S,D 3S,D#3S
3170 DATA E 3S,C 3S,D 3S,E 3E,B
     3S,D 3E
3180 DATA C 3Q.,C 3S,D 3S (note
     the "."!)
3190 DATA E 3S,C 3S,D 3S,E 3E,C
     3S,D 3S
3200 DATA C 3S,E 3S,C 3S,D 3S,E
     3E,C 3S
3210 DATA D 3S,C 3S,E 3S,C 3S,D
     3S,E 3E
3220 DATA B 3S,D 3E,C 3Q,C 3S,E
     2S,F 2S
3230 DATA F#2S,G 2E,A 3S,G 2E,E
     2S,F 2S
3240 DATA F#2S,G 2E,A 3S,G 2E,E
     2S,C 2S
3250 DATA B 1S,A 2S,B 2S,C 2S,D
     2S,E 2S
3260 DATA D 2S,C 2S,D 2S
3270 DATA C 2E,G 1E,C 1E
5000 REM END MARKER
5010 DATA "R 1W","X"
```


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Figure 3

TRANSITION MUSIC PLAYER

Note: Subroutines 1000 and 2000 are in Program A.

```
 10 REM TRANSITIONAL MUSIC
 20 GOSUB 2000
 30 D=10
 40 DIM C$(36)
 50 READ N,A$
 60 IF N>0 THEN 100
 70 C$(N)=A$
 80 GOTO 50
 90 REM SELECT START NOTE
100 N=INT(37*RND(1))
110 IF C$(N)="" THEN 100
120 REM PLAY & SELECT NEXT
    NOTE
130 GOSUB 1000
140 L=LEN(C$)
150 IF L=0 THEN END
160 R=INT(1+L*RND(1))
170 N=ASC(MID$(C$(N),R,1))-64
180 IF N<0 OR N>36 THEN
    PRINT "BAD NOTE": END
190 GET A$: IF A$="" THEN 130
200 END
3000 REM TABLE DATA
3010 REM FORMAT: NOTE#,
     CHOICE STRING
3020 DATA 1, GI
3030 DATA 2,KM
3040 DATA 3,OQ
3050 DATA 4,WY
3060 DATA 5,CA
3070 DATA 6,DB
3080 DATA 7, EC
3090 DATA 8,FD
3100 DATA 9,LN
3110 DATA 10,GE
3120 DATA 11,IP
3130 DATA 12,JH
3140 DATA 13,PS
3150 DATA 14,JR
3160 DATA 15,RT
3170 DATA 16,NL
3180 DATA 17,TO
3190 DATA 18,PN
3200 DATA 19,VW
3210 DATA 20,RP
3220 DATA 21,XY
3230 DATA 22,TR
3240 DATA 23,US
3250 DATA 24,VT
3260 DATA 25,ZM
3270 DATA 26,AN
4000 REM END MARKER
4010 DATA -1,XX
3000 REM TABLE DATA
3010 REM FORMAT:
     NOTE#, CHOICE STRING
3020 DATA 1,AAAXXDDDNO
3030 DATA 2,BBBYYEEEOP
3040 DATA 3,CCCZZFFFPQ
3050 DATA 4,DDDAAGGGQR
3060 DATA 5,EEEBBHHHRS
3070 DATA 6,FFFCCIIIST
3080 DATA 7,GGGDDJJJTU
3090 DATA 8,HHHEEKKKUV
3100 DATA 9,IIIFFLLLVW
3110 DATA 10,JJJGGMMMWX
3120 DATA 11,KKKHHNNNXY
3130 DATA 12,LLLIIOOOYZ
3140 DATA 13,MMMJJPPPZN
3150 DATA 14,NNNKKKQQLM
3160 DATA 15,OOOLLLRRKL
3170 DATA 16, PPPMMMSSJK
3180 DATA 17,QQQNNNTTIJ
3190 DATA 18,RRRMMMUUHI
3200 DATA 19,SSSPPPVVGH
3210 DATA 20,TTTQQQWWFG
3220 DATA 21,UUURRRXXEF
3230 DATA 22,VVVSSSYYDE
3240 DATA 23,WWWTTTZZCD
3250 DATA 24,XXXUUUAABC
3260 DATA 25,YYYVVVBBAB
3270 DATA 26,ZZZWWWCCAM
4000 REM END MARKER
4010 DATA -1,XX
```

If Note 1 is played, then the next note must be 2 or 3. A look at this shows that an irregular rising tune would always be played. An entire table for all 36 notes can be constructed, with the chance for each new note indicated — the above list would be like this:

	New Note						
Old Note	1	2	3	4	5	6	7
1	0	.5	.5	0	0	0	0
2	0	0	.5	.5	0	0	0
3	0	0	0	.5	.5	0	0
4	0	0	0	0	1	0	0
5	1	0	0	0	0	0	0

Changing the values in the "transition table" will change the "style" of music made. As programming this is a formidable task on the PET (That's a challenge for you!!), let's look at a simpler scheme. First, let's only use the 27 notes 0 to 27. This can be converted to the characters @ to Z. Second, use an array of strings, one for each note, to indicate the possible choices. Our little tune above becomes:

NOTE	Choices String
1	"BC"
2	"CD"
3	"DE"
4	"E"
5	"A"

The last thing is that the chances for a given note in the string is 1/(length of string) — so BC in the first note's choices has equal chances of choosing B or C (2 or 3). If you want to make one note more likely than another, just repeat it — for example, "AAAAB" will choose A 4/5 of the time, and B 1/5 of the time. If there is no choice for a note (null string), the tune will end.

Figure 3 shows the transitional music program. Subroutines 1000 and 2000 are the music player (Program A) so they aren't listed twice. Two transition arrays are shown in the Data statements which sound quite different. If you want a smoother sounding player, use the subroutine 1000 in the Scott Joplin program and add these Lines:

```
135 N1 = N
185 IF N=N1 THEN T1=TI: GOSUB
    1050
200 POKE AW,0 :END
```

More complex rules for composition can be devised and made for the PET, though there comes a point where finding the next note cannot be finished while playing the previous one. In the 18th and 19th centuries, many compositional schemes were devised to simulate most of the styles of music of the times — let me know if you build a PET sonata player. ■

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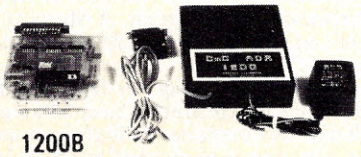

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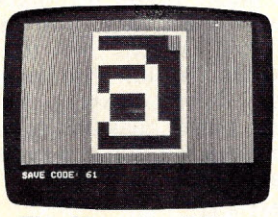

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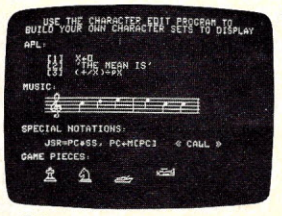

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CIRCLE 157 ON READER SERVICE CARD

Record Reviews: The New Digitals, Some Old Binaurals

David H. Ahl

Holst: Suite #1 in E-flat, Suite #2 in F; Handel: Music for the Royal Fireworks; Bach: Fantasia in G. Frederick Fennell, The Cleveland Symphonic Winds. Telarc 5038. $14.95. (Telarc Records, 4150 Mayfield Rd., Cleveland, OH 44121).

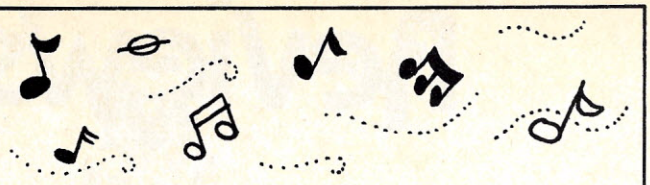
Stravinsky: The Firebird; Borodin: Overture and Polovetsian Dances from Prince Igor. Robert Shaw, Atlanta Symphony Orchestra and chorus. Telarc DG 10039.

These discs are two of the first truly digital recordings. This means the sound goes from microphone directly to an analog-to-digital converter which samples it 50,000 times per second; each "sample" is then recorded in memory. The process is fully described in the extensive jacket notes on the two Telarc disks.

The music? First of all, it has amazing depth and clarity. The incredibly deep bass will blow you right out of your seat. I have a pair of ancient AR-2 speakers which, if nothing else, have superb bass response even compared with Klipshorns and other exotica. However, even at modest volume, my AR's were literally quaking on their stands. Don't get me wrong—I'm not a bass nut—but the fantastic sense of being in Row 1 a few feet away from the bass and 'cello sections was overwhelming. The Holst suites are particularly impressive. (I listened to the same piece on London Phase 4 and Mercury "Living Presence"—recordings which are awfully good—right after the Telarc one and there's just no comparison. The Telarc disks blow the others out).

Incidentally, with these disks it is very important to have a more-than-decent sound system (leave the kids' portable out of this), however it is truly the record that makes the difference. I tried the Telarc disks driven by a Scott 40-watt amplifier into Fisher FP-9 and Radio Shack Optimus 1B speakers as well as the AR-2's and all combinations sounded great. A Marantz 55-watt amp driving a pair of Lafayette Criterion 2002's produced equally mind-boggling results.

Today Soundstream and 3M are among the few manufacturers of digital sound recording equipment. A basic setup goes for a cool $150,000 which partially explains the high list price of the records. Nevertheless, you owe it to yourself to try at least one of these discs.



Stravinsky: Concerto in D; Bach: Brandenburg Concerto #3, Suite for Strings; Villa-Lobos: Bachianas Brasileiras #5. Willis Page, Orchestral Society of Boston. Cook 1026. (Cook Laboratories, Inc., P.O. Box 802, Norwalk, CT 06854).

"The Organ At Symphony Hall" (Boston) played by Reginald Foort. Cook 10545.

"Percussion and Pedal" Vols 1 and 2. The Richmond Mosque organ played by Reginald Foort. Cook 10501, 10523.

Dubois: The Seven Last Words of Christ. Willis Page, Boston Chorale. Cook 1094.

No, not only new is great. I recently had the good fortune to obtain several rare unplayed Cook discs made in 1952!! (Can you imagine, this is truly "ancient history"—transistors were not yet invented and stereo records were called binaural). I previously had a number of Cook records but all had been played hundreds of times on cartridges with tracking weights of 3 to 5 grams or more which absolutely destroys the grooves.

Anyway, these new ones prove that there was some fantastically good sound way back then. Not digital, mind you, but these pure virgin vinyl records have exceptional highs and remarkable presence.

The Foort organ disks are the showy ones, but personally, I'd select 1062 (Stravinsky, Villa-Lobos and Bach) or 1094 (Dubois) for outstanding performances that you'll want to play over and over. A word of warning: these discs are long out of print and are probably available only from the dusty back shelves of the largest and oldest dealers. Worth checking on tho!

PET WORD PROCESSOR

This program permits composing and printing letters, flyers, advertisements, manuscripts, etc., using the COMMODORE PET and a printer.

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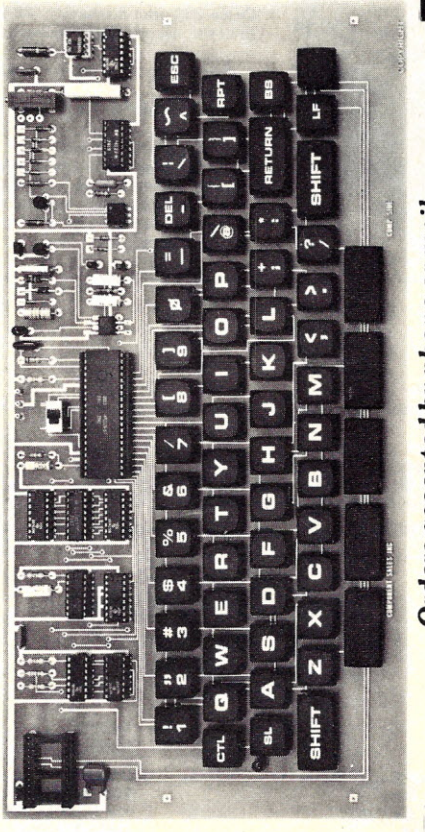

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CIRCLE 185 ON READER SERVICE CARD

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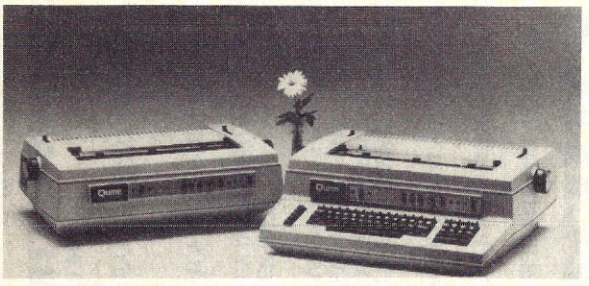

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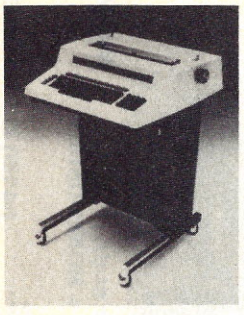

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Reviews

Stephen B. Gray

Consumer's Guide to Personal Computing and Microcomputers, by Stephen Freiberger and Paul Chew. Hayden Book Co., Inc., Rochelle Park, NJ. 176 pages, paperback $7.95. 1978.

Although a dozen of the 64 microcomputers described here are commercial computers, or software development items, the comments offered are of value. This may be the only book to contain comments such as, on the Poly 88 System 6, "Each expansion chassis has its own power supply. However, this can be cumbersome with respect to space." And on the now-defunct Sphere 310, "This system does have several limitations." However, most of the comments are laudatory, and no adverse comments are made regarding many computers that are generally known to have problems.

After two picture-filled chapters on the basics, there are chapters on Input/Output Devices, Software, Selection and Sources of Hardware and Software, Microcomputer Systems (Sol 20/8, Heathkit H-8, PET, etc.), Limited Input/Output Systems and Systems on a Card (MIKE 3, COSMAC VIP, KIM-1, etc.), Microcomputers in a Cabinet (IMSAI 8080, Poly 88, PCM-12A, etc.), Microcomputers on a Card and CPU Cards, and Microprocessors (with a two-page chart of various types).

The book ends with a four-page Reader Response Survey that "provides reader feedback and suggestions to the authors." For a second edition?

Available from Creative Computing Book Service.

● ● ● ●

Computers and Communication: Implications for Education, edited by Robert J. Seidel and Martin Rubin. Academic Press, New York. 429 pages, hardcover $15.50. 1977.

This is the proceedings of the conference on Computer Technology in Education for 1985, held at Warrenton, Virginia in Sept. 1975. Many of the names of the authors of the three dozen papers will be recognized by *Creative*'s readers, including Dave Ahl, Alfred Bork, Ludwig Braun, and Thomas A. Dwyer, and most of the rest are well known in the educational field.

The papers are in five categories: LSI Technology and 1985 Educational Computing Systems (The Million-Terminal System of 1985, The Personal Computer and Education), Storage Technology: Effect on Education (magnetic-bubble technology, A Database Resource Center); What Do Developments in Communications Imply for the Distribution of Educational Resources? (Broadcast Delivery of CAI, Dave Ahl's Does Education Want What Technology Can Deliver?), If the Machine Gets Smarter, Does the Student Learn More? (artificial intelligence, A Learning Environment for Children), and How Will Improvements in Man-Machine Interface Affect Learning? (Learning through Graphics, Intelligent Video Disk Systems).

These are only a few of the papers presented by an outstanding group.

● ● ● ●

Bugbook VII: Microcomputers—Analog Converter, by Jonathan A. Titus, Christopher A. Titus, Peter R. Rony, and David G. Larsen. E&L Instruments, Inc., 61 First St., Derby, CT 08418. 284 pages, paperback $8.50. 1978.

Bugbook VII's full subtitle is "Microcomputer—Analog Converter Software and Hardware Interfacing With Experiments for 8080A/Z80/8085 Systems."

The book demonstrates how 8080-family microcomputers are interfaced to real-world analog devices for measurement, control and display applications. The nine experiments are configured for the E&L MMD-1, an 8080A-based micro, and include program-controlled waveform generators, data-acquisition and display systems, a precision voltage-measuring system, and CRT-display generators. A great deal can be learned from the book without having a computer, but all the examples and experiments do assume the use of an 8080-based micro with an uninverted, bidirectional data bus.

Bugbook VII begins with microcomputer interfacing to D/A converters, and proceeds to software control of ramp, successive approximation, and dual-slope A/D converters. Data acquisition approaches using software interrupts and real-time clocks are compared. Sample-and-hold amplifiers and analog multiplexers take a chapter. The factors in selecting and interfacing packaged A/D and D/A data-acquisition modules are treated in an appendix.

● ● ● ●

Your Own Computer, by Mitchell Waite and Michael Pardee. Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis, IN 46268. 80 pages, paperback $1.95. 1977.

According to the preface, "The purpose of this book is to introduce the novice to the new home computers and to reveal in the simplest possible terms the incredible potential of these technical marvels.... This book has been especially designed to be your first investment in the personal computer field."

On that basis, it's worth the $1.95, as a surface treatment that presents about as much detail as possible in 80 pages. The language is simple, all acronyms are explained, an eight-page "Glossary of Computer Buzz Words" is provided, many photographs are used, and the drawings are entertaining.

The five chapters are: Introduction, Personal Computer Applications, Programs for Your Computer, Nuts and Bolts (hardware), and Getting Started (educating yourself, buying a computer).

The authors do very well in living up to their prefaced hopes, "Because of the stigma of complexity and mystery that surrounds the computer, it is hoped that in these pages you will find that, in fact, computers are simple, easy to understand, and, most of all, extremely helpful devices."

● ● ● ●

The Computer Quiz Book, by Donald D. Spencer. Camelot Publishing Co., Box 1357, Ormond Beach, FL 32074. 128 pages, paperback $5.95. 1978.

Written for anybody who would like to test himself on basic computer concepts, this book contains 425 multiple-choice questions under these headings: history, applications, equipment, programming, languages, data processing, computer concepts, number systems and codes, and occupations. Answers to all "exercises," as the author calls them, are at the back of the book, along with the solutions to the eleven simple, computer-oriented crossword puzzles.

Few of us could get anywhere near 100 percent correct on these 425 questions, since they require at least a superficial knowledge of more fields than most of us are familiar with. What is the Japanese word for abacus? A language for simulation problems is called (APT, SIMSCRIPT, BASIC, or LOGO)? A technique used to fill out a block of information with dummy records, words, or characters is called (packing, shifting, padding, or moving)? The top edge of a punched card is called the (4, 12, 6 or 10) edge?

This is a good source of quiz material. As the preface notes, "Teachers are advised to use the exercises in their classes, expand them, and create more of their own."

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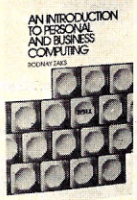

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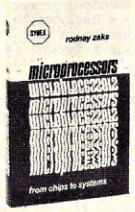

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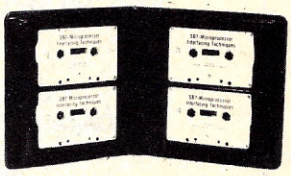

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CIRCLE 181 ON READER SERVICE CARD

Small Systems Computers Sourcebook, edited by J.C. Boonham. Rococo Press Ltd., distributed by Chapman and Hall, London; distributed in the U.S.A. by Halsted Press, div. of John Wiley & Sons, New York. 153 pages, paperback $14.95. 1978.

Although published in England, this book, "devoted to those small computer systems currently on the market which are based on microprocessor integrated circuits," is almost entirely about American machines. What few prices are given, mostly for comparisons, are in dollars.

The main part, 83 pages on Available Hardware, provides the specs (and photos) of a great many of the personal computers and peripherals available, giving great attention (by covering most of their products) to OSI, MITS, Cromemco, E&L, Intersil, North Star, MAI, Solid State Music, Tarbell, TDL (now Xitan), Vector Graphic and Wave Mate. Also included is information on some commercial micros and peripherals, from Data General, Honeywell, Intel, Motorola, National Semiconductor, TI, etc.

The other main section, 30 pages on Software, gives the specs on various operating systems,. editors and other utility programs, assemblers, high-level languages, and a couple of games.

Designed to "assist the prospective purchaser in many fields," this handsomely produced book makes a splendid reference work.

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An Introduction to Personal and Business Computing, by Rodnay Zaks. Sybex, Inc., 2020 Milvia St., Berkeley, CA 94704. 245 pages, paperback $6.95. 1978.

Fourteen chapters and six appendixes here provide a good "introduction to all the elements of a real computer system" for "the reader who does not know about computers yet."

The first three chapters are introductory, covering system components and basic definitions. Chapter four, on How it Works, "will take you inside the box." The next two chapters look at software, with a very good short summary of BASIC and a quickie on APL.

Chapter seven looks at Business Computing, and the remaining chapters provide information on choosing a computer: Selecting a System, The Peripherals, Selecting a Microcomputer, Economics of a Business System, How to Fail With a Business System, Help, and Tomorrow. The "How to Fail" chapter tells what can go wrong with hardware, software, and security.

The apendixes are on Computer Logic (gates and flip-flops), Bits and Bytes (number systems), Basic Computer Communications, Files and Records, and lists of business-systems and microcomputer manufacturers.

The many photos and drawings add to the usefulness of this text.

● ● ● ●

Programming in BASIC for Business, by Bruce Bosworth and Harry L. Nagel. Scientific Research Associates, Inc. 239 pages, paperback $8.95. 1977.

This textbook "can be used in a course completely devoted to computer programming. It can also be used as a supplement in a course on data processing." After a brief introduction to programming, flowcharting and timesharing in Chapter 1, eight chapters provide a short course in BASIC. Chapters 10 through 13 cover advanced aspects of BASIC, including string variables, PRINT USING, matrices and data files.

Most of the programs are short, 10 to 20 lines in length, and nearly all but the simplest ones are business-oriented. The writing style is clear and concise. Exercises are provided at the end of each chapter; the back of the book has answers and solutions to selected ones.

If fault must be found, then the Teletyped examples could be 15 to 20 percent larger, for increased readability, since the book has extra-wide margins (an inch inside, 1½ inches outside) that are not put to good use.

That's a small point, however, in a book that's very well designed as well as being very easy to read and understand.

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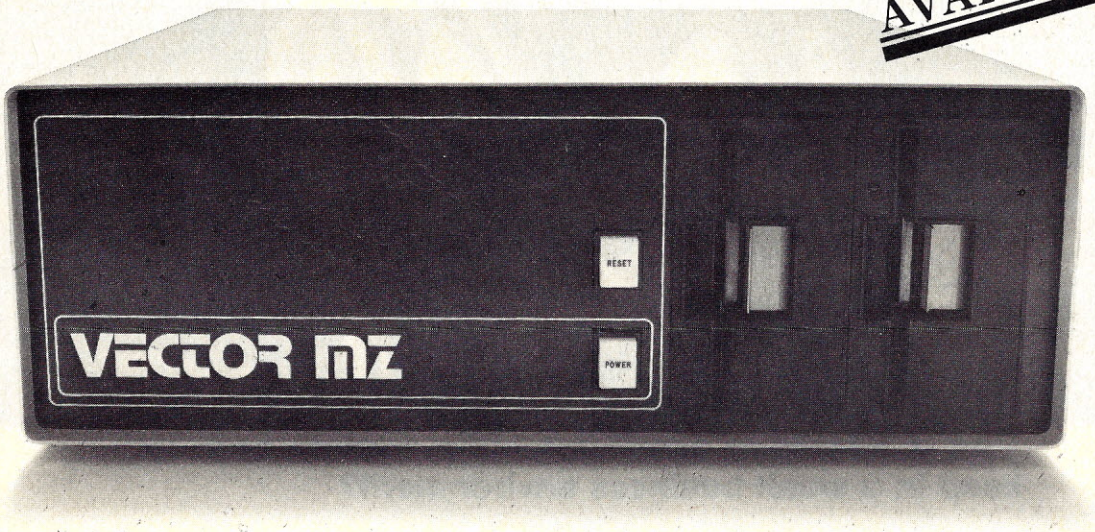

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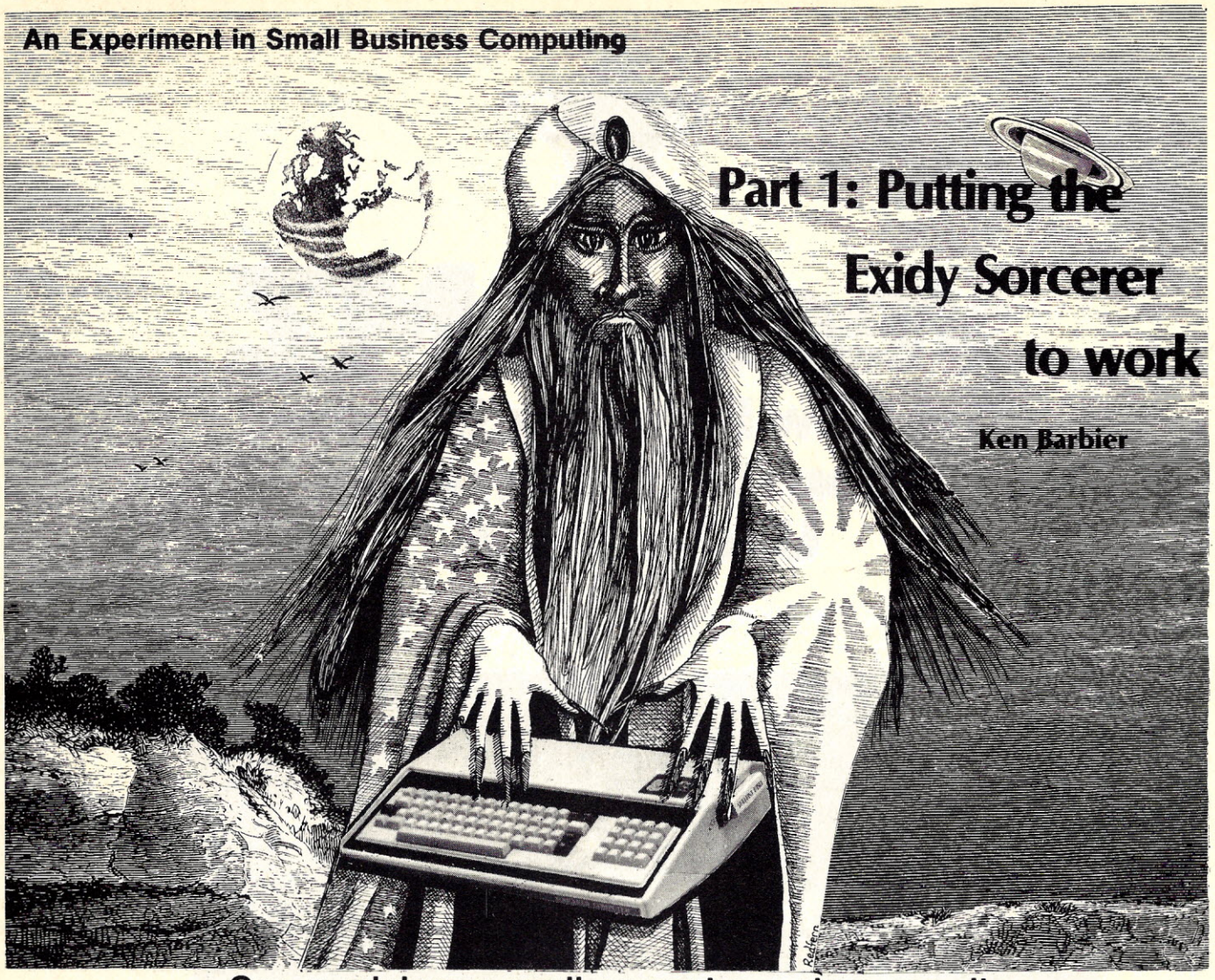


Part 1: Putting the Exidy Sorcerer to work

Ken Barbier

Can a minimum small computer system earn its keep in a small business environment?

Everyone knows what wonderful things a business computer can accomplish. Such as, relieve the bookkeeping department of much drudgery or make inventory control so efficient that capital requirements are minimized. They can also issue dunning letters to accounts with a balance of "$0.00" and insist on receiving payment in that amount.

The proprietor of a small business has heard both sides of the story. The wonderful accomplishments of computers, and the awful. However, today the wonders overwhelm the terrors, and hardware prices have dropped to such a low range that the equipment required becomes cost effective when compared with the potential savings in time.

Still the rush to buy is only a fraction of what it could be. The greatest objection to the packaged computer/software small business system is that it requires the user to do things the way the computer wants them done.

Larger companies with full time accountants have little trouble adapting to the better software packages, since both use "accepted accounting practices." The owners of the hordes of Mom and Pop stores who can now afford a computer are reluctant to adapt their way of life to that required by the new "servant." They wonder who is the master.

Long before the urge to purchase a computer for the business occurs, they are exposed to influences like the letter from a supplier with fouled up deliveries which explains apologetically: "...because of rapid growth, was forced to jump into the Computer Age the hard way.... then the plague started ... a firm lacking the technology or financing to do the job .... constant delays on promises of parts ... forced to buy a new larger computer, procure a skilled programmer and staff."

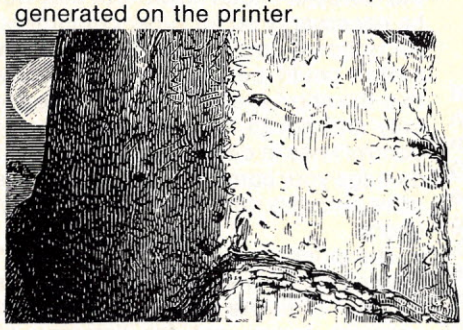
That letter was actually received by Randy and Betty Townsend, who own the Borrego Hardware Co., in the little desert town of Borrego Springs, California. No stranger to the field, a decade ago Randy was employed by a computer manufacturer. However; he knows that a lot can change in ten years, and he hasn't even tried to keep up. Why try, when living in the clean fresh desert air is the alternative to employment in the smog-bound computer industry?

Since Randy knew that I had been keeping up with small computer technology he asked me to help him find a system which could speed up the most time consuming tasks in the store: inventory control and billing. We discussed the available general ledger packages also, and he and Betty agreed that adapting to someone else's procedures was not worth the time saved. So conversion to a computerized general ledger system was tabled. However, inventory control and billing were real problems due to the number of stock items and the large percentage of their customers who charge purchases.

Ken Barbier, Borrego Engineering, PO Box 1253, Borrego Springs, CA 92004.

A quick analysis of the inventory problem proved that a system with dual floppy discs was the minimum configuration that could handle the large number of low cost items that is the basis of the hardware business. My first estimate of $8000 for hardware alone rapidly cooled off the inventory control fervor. I suggested that a consortium of about four local retailers could support a really practical system. While this solution was economically attractive, it would create its own problems with scheduling and that most difficult area of system design, the human-to-human interface.

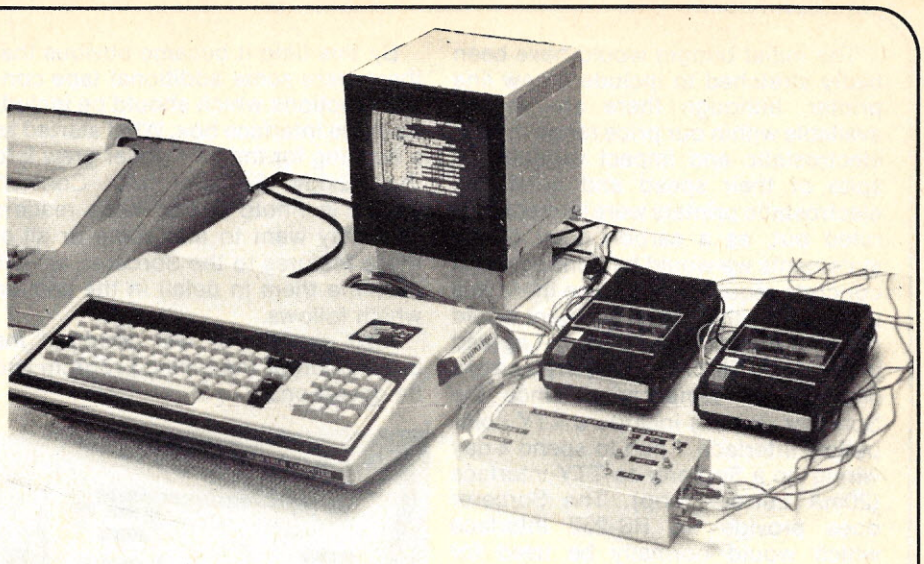
Suddenly there appeared on the market a new computer with a combination of features that seemed to eliminate the need for the floppy discs. The Sorcerer Computer from Exidy, Inc. seemed the perfect medium to fulfill our immediate requirements. The computer comes complete with interfaces for two cassette tape recorders and a printer. This minimum configuration will allow real data processing: old records are read in from one tape and displayed on the CRT monitor; current data is input through the keyboard; an updated tape is written on the other cassette; and the required report is generated on the printer.



The Great Experiment

These procedures are basic to every data processing task we could imagine, and would provide the capability to handle the two tasks we had originally proposed, as well as many others. The greatest disadvantage of the cassettes versus disc is in data transfer rate, and we never lost sight of the fact that such a system would be slow. With this in mind we agreed to an experiment: we would spend less than $2000 on hardware, develop the software on a time-as-available basis, allow no interference with the "old way" of doing things in the store, and if the system did not prove capable of earning its keep in two month's time, abandon the project.

There are some healthy attitudes obvious in that last paragraph. All the horror stories they had read provoked the Townsends into the conviction that they would not be lured into blind reliance on any pile of hardware and software. My experience with developing software packages made me reticent to guarantee beforehand that what I was going to do would be economically feasible. I tried to impress upon them that operation with the cassettes would be slow, but could of course be overlapped with other tasks around the store.



A "kitchen table" computer system based on the Exidy Sorcerer computer, ready to begin earning its keep as a small business computer in a small store.

We agreed to experiment.

That experiment is still in progress. While the final results are not yet in, Betty has informed me that no way am I ever going to pull the plug on "her" computer. The major question yet to be answered is: Are the results worth the time invested?

Since we each value our time at a different rate, the question cannot really be answered. If you have time to spare and would enjoy the challenge of developing your own software package designed to do things your way, I would recommend giving it a try. I'd be willing to bet that you will come out way ahead in the long run.

Specifying the First Task

With Borrego Hardware Company's large percentage of charge account customers, there is a first of the month rush to prepare and mail statements. Before the arrival of the Sorcerer, this task involved much long hand calculating and writing of addresses. It was an obvious candidate for selection as the first job to be automated.

It was also an easy task to specify (if not to code) as the computer would be merely duplicating a procedure already handled by humans. That procedure includes:

1. Input a customer account record.
2. Subtract payments from previous balance to give new balance.
3. Total taxable charges.
4. Compute sales tax.
5. Total non-taxable charges.
6. Add 1, 2, and 3 to new balance to give closing balance.
7. Print a statement.
8. Write out the updated account record.

The actual flow of activity is virtually identical to that described earlier as "real data processing." Without going into details of the program and operator activities at this time, we can see in Figure 1 the end result of these operations. Here we see a sample statement which when folded and stuffed into a window envelope provides the mailing address as well as the account data.

All this had been previously written out long hand. With over four hundred credit customers to process each month, it is no wonder Betty is happy with the automated system, slow as it is.

Let's look now at the hardware required to accomplish this task.

BORREGO HARDWARE CO.
652 Palm Canyon Drive P.O. Box 725
Borrego Springs, Ca. 92004
Phone 767-5310

14 11/02/78

INSECREVIO COMPUTER CORP.
998 DRELB AVE.
BORACHO CITY , TX 88899

PREVIOUS BALANCE	123.45
TOTAL PAYMENTS	23.45
NEW BALANCE	100
TAXABLE CHARGES	400.17
SALES TAX	24.01
NON-TAXABLE CHARGES	0
CLOSING BALANCE	524.18

STATEMENT

[FIG 1]

A highly fictionalized sample statement, as prepared by the Billing program, the first task tackled by the new system.

Selecting the Computer Hardware

The Sorcerer was picked for the CPU as it had the interfaces we needed ready to go without having to add an expansion chassis, except....

The initial budget would have been badly stretched to include a new line printer, although there are several available within our price range in both electrostatic and impact varieties. In spite of their speed and quiet, the electrostatic printers were immediately ruled out, as a carbon copy of the statements we would be printing was a concrete requirement. Since there was a possibility that the experiment would fail after the first month's run, I agreed to use my ASR-33 Teletype in place of a line printer, temporarily. Since the Sorcerer did not include a TTY compatible interface, I had to spend a day wiring up a Sorcerer-to-TTY interface (20mA current loop). The Sorcerer does provide an RS-232 interface which would normally be used for connecting a printer.

A 110 baud printer would seem to be a poor choice, but since we were going to be working with slow tapes anyway, the extra time for slow printing was not expected to be as much of a disaster as it might seem. Besides, it was only "temporary."

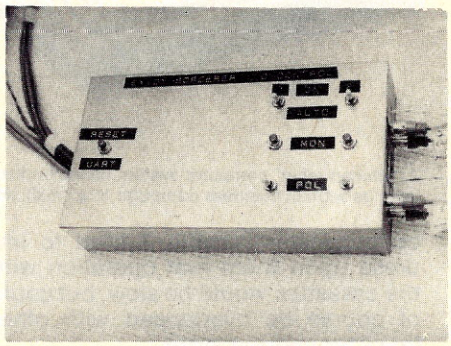
A high resolution CRT monitor was also borrowed from my stock to get the system going. Meanwhile Randy was modifying an inexpensive TV set for permanent use in the hardware store. This required the installation of a line isolating transformer, and a video jack coupled into the set's video amplifier stage. The Sorcerer's video output signal proved compatible with both the monitor and the modified TV set.

Two Radio Shack model CTR-40 cassette recorders were smuggled out of their store while Radio Shack's own TRS-80 computer wasn't looking. We didn't want to hurt its feelings, using the recorders on a competing machine. They have proved to be operationally compatible with the Sorcerer's interface, but in order to connect the second tape to the Exidy computer, some connectors and cables had to be added.

As it comes out of the box, the Sorcerer computer includes a video output jack and matching cable, and the jacks and cables to provide the audio signals for recording onto and reading from one cassette only. The other interfacing signals we would need, including the motor on-off controls for both tape decks, appear on a DB-25S connector on the back panel of the computer. This necessitates the purchase or construction of a cable to run from the DB connector to cassette compatible plugs. Since we also needed to connect to the Sorcerer's parallel output port (on another DB-25S connector) for the TTY interface, we decided to build up our own cables and an interface box to house the TTY driver.

By this time it became obvious that there were some additional tape control functions which should be included in the interface box. What started as a housing for the TTY driver grew into the "Exidy Sorcerer I/O Control" shown in Photo 2. For those readers who may want to add some or all of these features to the Sorcerer, we will examine them in detail in the section which follows.

Next month we will continue the description of the billing program and its operations.



[PHOTO 2]

The added control box, which includes auxiliary cassette tape recorder controls and the interface to the Teletype machine used as an inexpensive printer.

Cassette Tape Controls

Three auxiliary controls for each of the two cassette recorders appear on the top of the I/O Control. For each cassette there is a motor ON-AUTO switch. This allows you to override the computer's motor control permitting the operator to FAST FORWARD, REWIND, or PLAY a tape even though the computer has not requested any tape operations. Augmenting this control is the MON switch, which is a push button allowing the tape audio to be monitored by a speaker built into the control box.

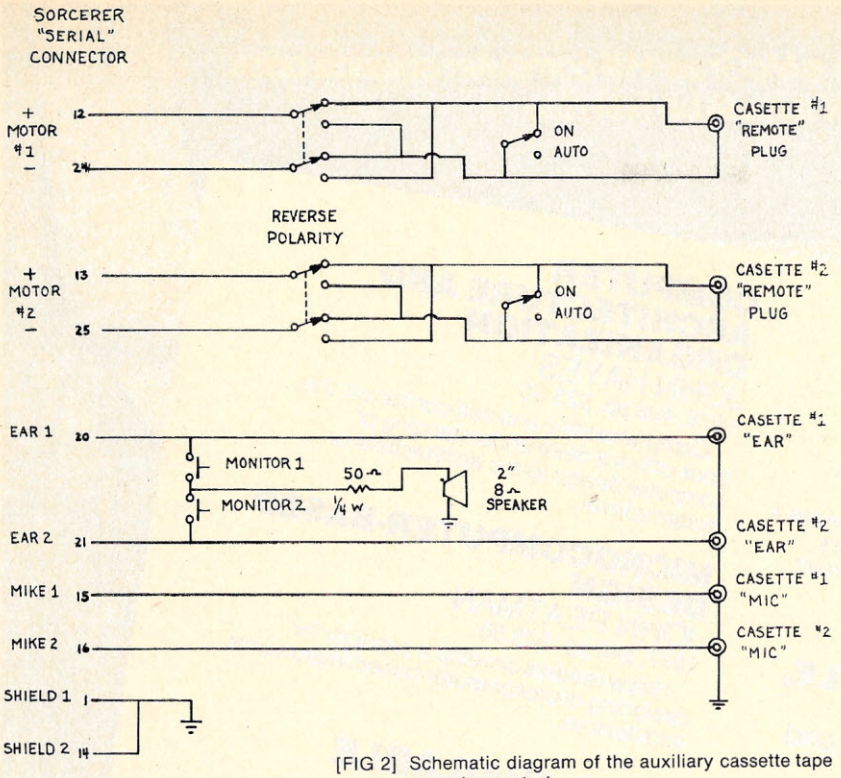
The use of these switches becomes obvious once you have tried to operate without them. The most common use is to rewind a tape that has been read. They can also be used to find a particular record on a tape, or to listen for suspected tape "drop outs" or changes in level which are not too uncommon with some cheap tape. Such tapes are not bargains for computer use.

The POL switches allow the use of cassette tape drives with different polarities of motor drive voltage. We discovered that there is a polarity difference from one cassette manufacturer to another when the connections for the Sanyo cassette first used proved to be different from the Radio Shack units later connected. The POL switches allow instant reconfiguration of the motor drive to permit changing from one make of deck to another. They are obviously optional if you never need to make the change.

Figure 2 is a schematic of the tape control functions of the control box. You will note that in the ON position the motor drive switch places a direct short across the computer's motor control lines. This is perfectly compatible with the Sorcerer motor driver but may not be necessarily so for other computers. An optional double pole double throw switch could be used here to insure that the short is applied to the cassette only and not to the computer's motor control lines in case such a short might damage your computer. The Sorcerer's drive circuit is not damaged by a direct short.

The monitor speaker we used is a 2" diameter 8 ohm speaker that provides usable volume (for monitoring program tapes, not for listening to music!) even with the 50 ohm resistor in series. The isolation provided by the series resistance is enough that monitoring a tape while the computer is loading from it does not cause trouble. Less isolation would allow the speaker to load the audio signal enough to interfere with the computer's ability to read the tape.

There is one caution to observe in the use of these controls. When the computer is trying to read from tape 2, for example, as directed by the operator or a program statement, it will turn on the cassette 2 motor only, but the computer's tape read circuitry *will "hear" signals from either tape.* If you have overridden the motor control on the other tape and are moving the tape in the PLAY mode, the two audio signals will be mixed together and a load error will occur. Fortunately, the cassette audio is muted in FAST FORWARD and REWIND, so these operations will not cause trouble. But be careful how you use the auxiliary controls.



[FIG 2] Schematic diagram of the auxiliary cassette tape recorder controls.

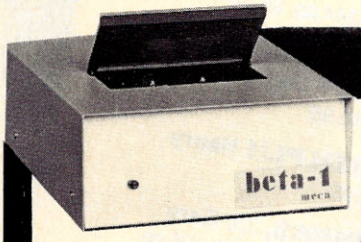
A similar condition is true on the tape write side. It is possible to write to both cassettes at the same time. With both tapes in RECORD mode, tell the computer to write on one, and use the ON-AUTO switch to run the second tape at the same time. You will end up with a duplicate tape in half the time!

Under the usually expected conditions, with one tape used for read, the other for write, and with the computer controlling both motors, these peculiarities of the tape I/O circuitry would cause no problems. Just be aware that using the auxiliary controls at the wrong time can give the Sorcerer a real headache.

Summary

It is reassuring at this point to realize that we have configured an under $2000 system which has already proved that it can earn its keep in a small business environment.

In next month's article we will take a close look at the billing program, and see how it operates. We may even give you a peek at the operator. ■



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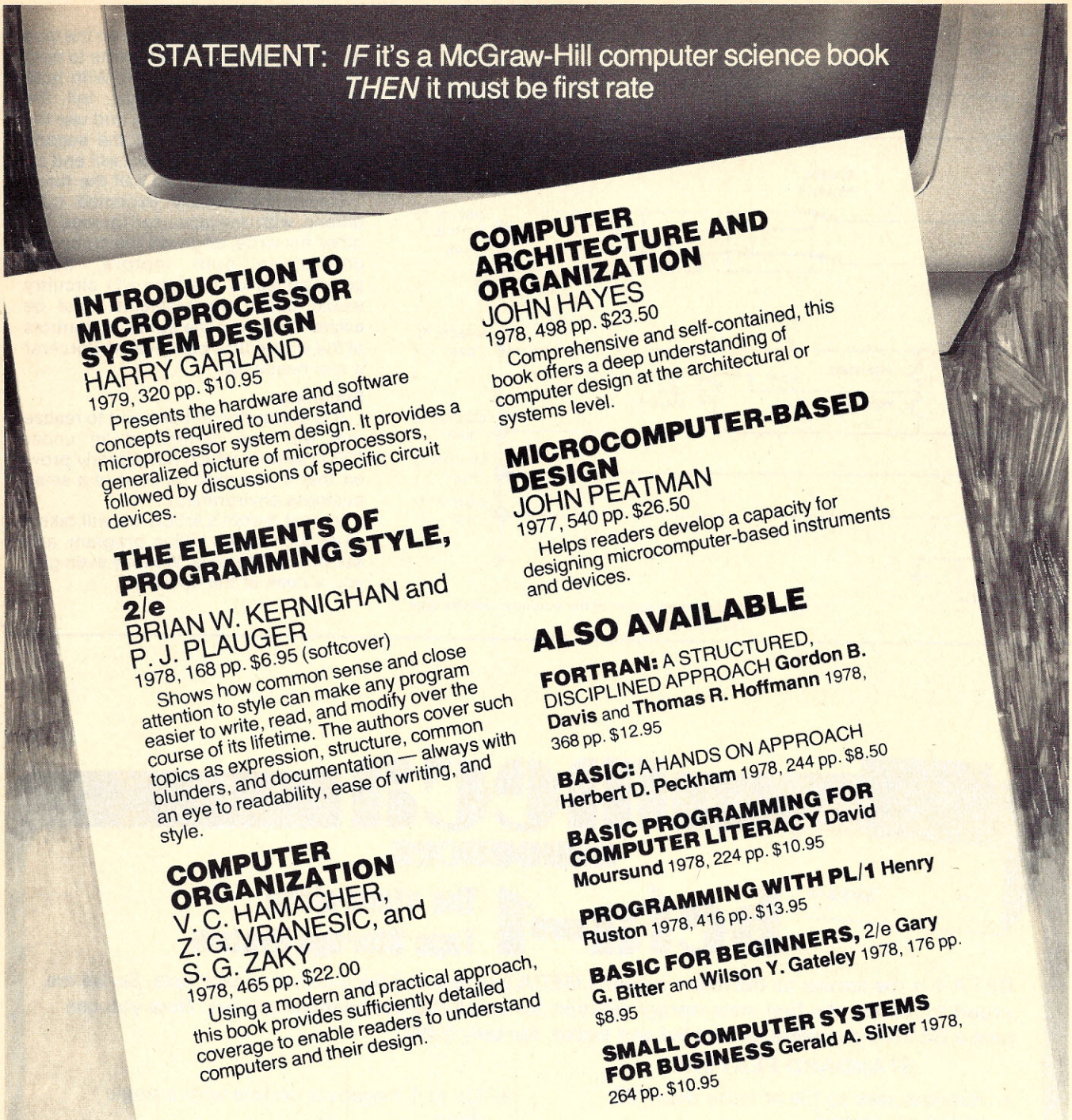
CIRCLE 184 ON READER SERVICE CARD



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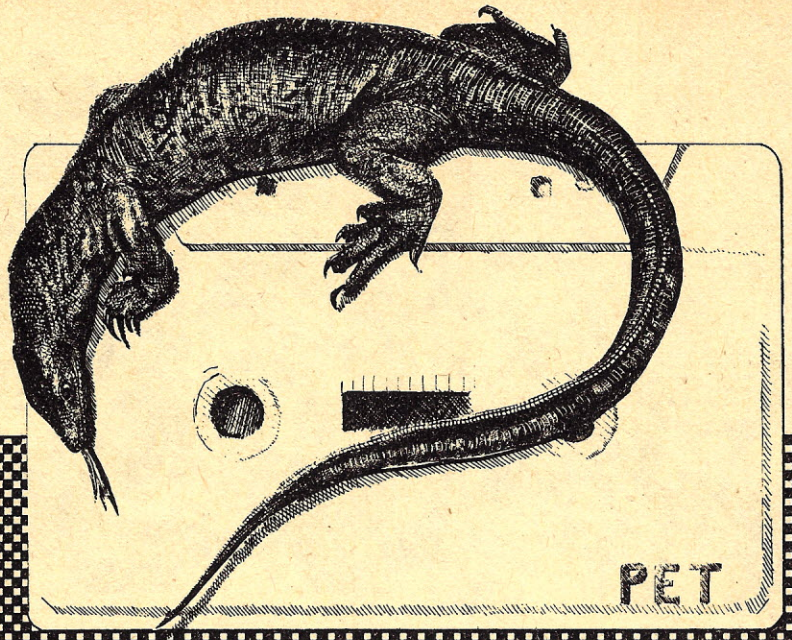


Les Palenik

"PET Machine-Language Programming....."

Tired of Basic? Here's a low-level monitor for expanding your PET's programming capabilities and for expanding your understanding of how the machine works.

After waiting over nine months for Commodore's Monitor program I found that Home Computer Centre in Toronto has been selling their PET-Monitor program for some time. The program comes on SONY 30 minute cassette with a 2-page program manual and sells for $20.

I immediately got one and began experimenting with it. The Monitor is written in BASIC using the PEEK and POKE commands. It occupies about 4.5K of memory which leaves enough room for machine language programs. The Monitor program could be compressed even more by using multiple BASIC statements, thus eliminating many line numbers. The Monitor uses the second cassette drive buffer for machine language programs so that the second drive cannot be used during the monitor execution.

The Display command is the most useful. It displays the memory address, memory contents in hexadecimal and in ASCII, which is quite handy. It will allow you to view all addresses within a PET which is not possible by using PEEK and POKE commands only. With the P and S commands one can create programs in MOS 6502 machine code and store them in any unused area.

I would like to see another command which would display the contents of the registers. A step command allowing a step-by-step execution of the entered program would be desirable, too.

Not being the best typist in the world I made several typing errors while operating the Monitor and found that in some cases no error message was displayed or that the error message was not very clear.

I would recommend this program to anybody who is interested in exploring his PET behind the BASIC level. It can be used for programming in machine language, familiarization with PET memory allocation and other research into PET operation. ■

Order info:
Home Computer Centre
6101 Yonge St.
Toronto, Ontario Canada. $20.

D - display contents of specified memory locations
P - Put ASCII characters into specified memory location
S - Substitute memory location with keyed hexadecimal value
G - Go to specified location and execute program
M - Move memory block to another location
Y - Search in specified memory range for a particular value
R - Read object code from a cassette into specified memory area
W - Write object code from memory onto a cassette
F - Fill memory block with specified hexadecimal code
Z - Set high address for BASIC programs

Table 1. PET-Monitor commands.

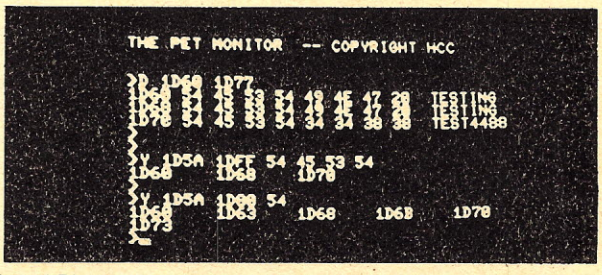
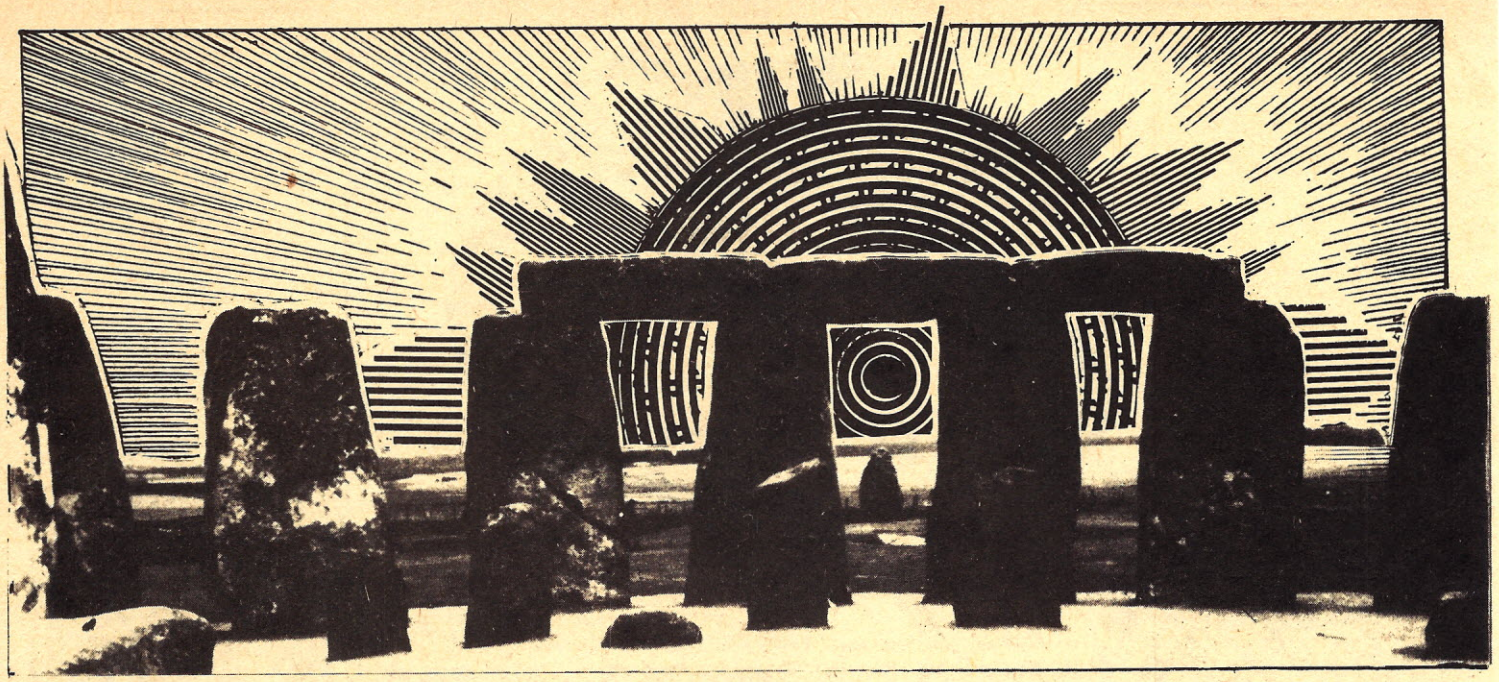


Photo 1. Display (D) locations ID60 thru ID77. Search (Y) for word "TEST" between locations ID5A and IDFF. (YID5A IDFF54 =T 45 =S 54 =T) Search for letter "T" (54 hex) between locations ID5A and ID80.

Les Palenik, 25 Silversprings Blvd., Suite 512, Ontario NIV IM9, Canada.



COMPUTING AT THE MILLENIUM

BY THOMAS M. DIETZ and C.A. JOHNSON

Thirty-five centuries ago, the ponderous structure of Stonehenge was the state-of-the-art in computational hardware. Progress has been slow but steady for about 99 generations. In the last half of the twentieth century, the pace of change has accelerated astronomically. On the horizon is a world permeated by networks of talking computers 10,000 times more powerful than current machines, filling space with three dimensional images. Computing has become more than a technology, more than a media. A technigenre of its own, computing already permeates every aspect of life, and yet its major impacts are only beginning to merge. *Creative Computing* (CC) and the DaVinci Group have used the expertise of the CC readership and a variety of data analysis tools to peer into the future of computing and its effects.

In the May/June 1977 issue, readers were asked to submit their questions, ideas and opinions on the future of computing. These responses, and a survey of the existing literature, were distilled into a questionnaire which appeared in the November/December 1977 issue. The response was amazing. More than 250 questionnaires were returned, along with dozens of insightful comments. Even the respondent profile is interesting. Since the respondents selected themselves, they are not necessarily representative of the overall CC readership. Questionnaires take time to complete, so our respondents are probably a bit more energetic, more bored, a bit less absent-minded or more interested in the future of computing than those who did not respond. In fact, the study is not focused on the representative random sample typically used in public opinion polling. The respondents are actively involved in computing (half use computers daily), thoughtful about its impacts and concerned enough to complete the questionnaire. The ways in which they differ from the general public or the overall CC readership are exactly what makes their participation uniquely valuable.

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Respondent Profile

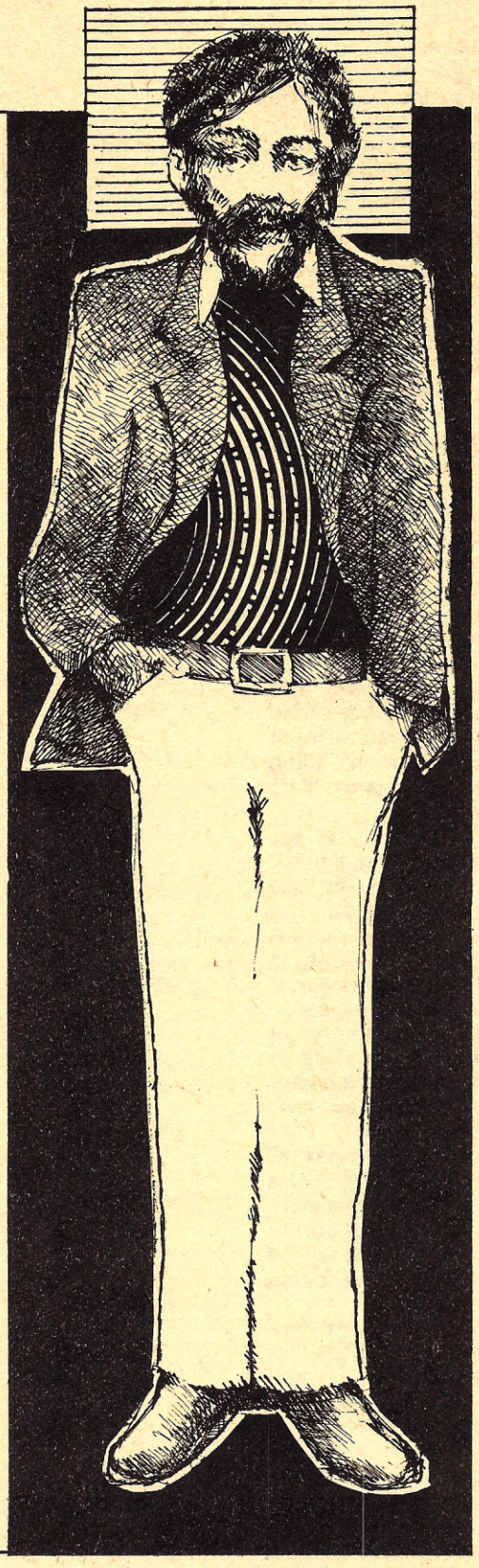
The average respondent was young, more than half of them were under 30, 85% were under 40. Only 4.2% were female, reflecting the overwhelming sex bias in computer science. Nearly 60% have a college degree, a substantial number were still in college and 20 had doctoral degrees.

About 40% of the respondents labeled themselves liberals. Forty-seven percent were optimistic about the future of the world, 57% felt optimistic about the future of the U.S., and 86% were optimistic about their own futures. This may reflect a realistic assessment of the fate of the technologically advantaged, or it may be no more than positive thinking.

Over 30% of our respondents were from California, New York and Ohio. The highest response rate per million population was from the District of Columbia, reflecting the prevalence of government and research employment there. Overall 43 states and 4 countries are represented in the results.

The varied written responses included the creative, provocative, dull, absurd, religious and downright funny. All respondents thought forecasting studies useful, but only 30% considered them *very* useful.

Respondents were asked to evaluate the likelihood, importance and desirability of each of forty events on a 1-5 scale. Using the Statistical Package for the Social Sciences on a Burroughs 6700, we generated descriptive statistics portraying the overall response patterns. Later reports will focus on more complex analyses. In this article we sketch the basic image of the future generated by our respondents. Our goal is to provoke further thought and debate by our readers. The technically inclined will find a summary of the results in the Data Cartagram as follows:



Male

Twenty-nine years old.

Ohioan currently working in Washington, D.C.

Liberal

Uses computers daily

Wears computer-designed Moire shirt

B.S. degree with some graduate work

Advanced, professional level training in Computer Science

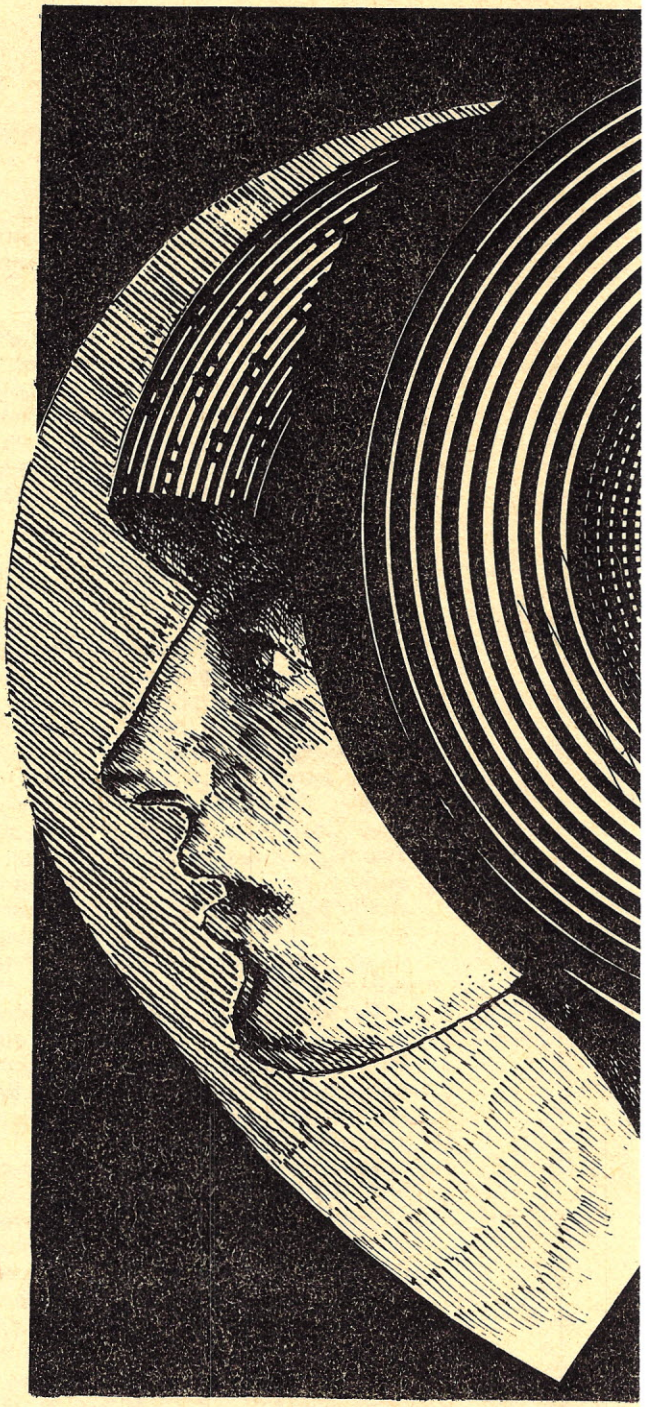
Optimistic about the future

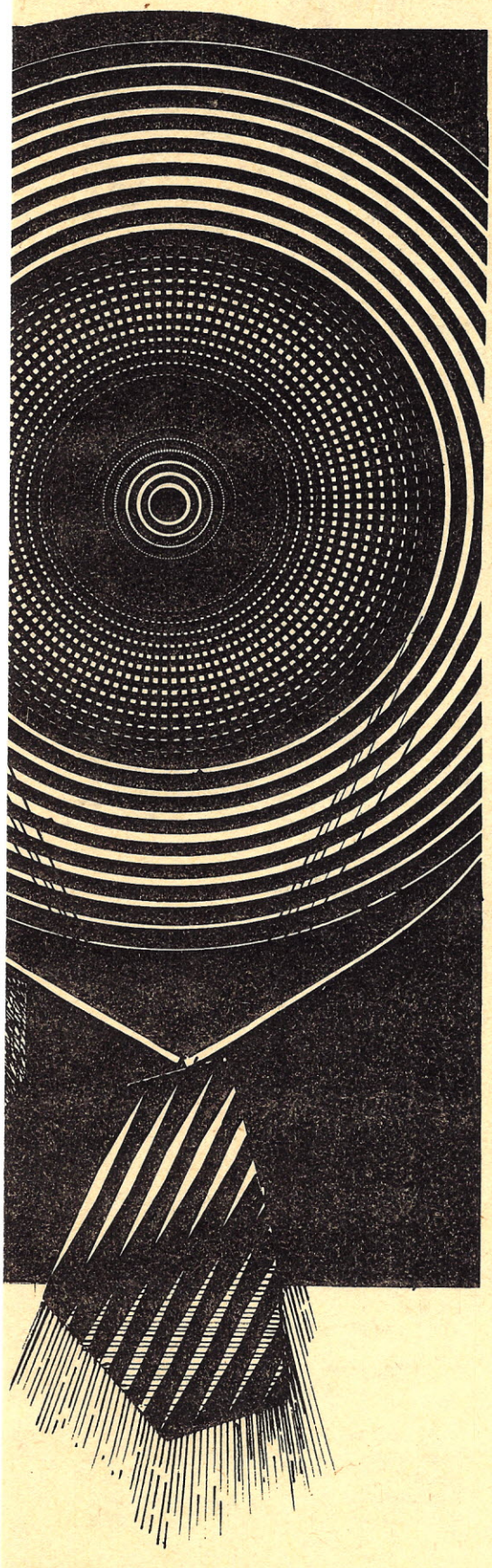
It is not surprising that 85% of those responding expect computing costs to drop by a factor of 100 in the next quarter century. Between 40 and 50% expect costs to decline by a factor of *10,000!* Over three-fourths thought the reduction important and highly desirable. The precipitous reduction in computing costs is consistent with the rise of micro-computers. Half the respondents expect pocket computers with a capacity equivalent to current third generation machines, with memories of a billion bits per cubic inch to back up the processing power. Sixty percent expect hand-held units capable of linking into computing networks from a distance of a mile.

These changes in hardware are impressive. However, many argue that software is the weakest element in current computer technology and the area where change will have the most dramatic impact. Over 75% of our panel expects to chat with their computer as conversation becomes a common mode of programming. Two-thirds want their computers to be educated rather than programmed in a traditional way, but only about 40% think this will actually occur. More than half expect holographic modes of input and output will be common, filling space with complex programs, data structures and images.

Will computers at the turn of the century be intelligent? There are many ways of defining intelligence, and thus many answers to the question. The mathematician Turing proposed a test which has come to bear his name. In one version of this test, an interviewer asks questions of an unknown respondent via a terminal. The interviewer must decide if the respondent is human or machine. The machine, which cannot be detected by most interviewers, is presumed intelligent. Roughly one-third of our respondents felt the next 25 years will see computers passing this test. Looking at intelligence from a different perspective, two fifths of our respondents thought computers with a measurable IQ of over 200 will come into existence.

There are limits to what our respondents feel will occur. Only about a third expect audio-kinetic programming (programming by song and dance). So much for the Fred Astaire School of Programming. One-fifth foresee direct brain-computer links. One-third expect a single network to link most computers. Only about 10% anticipate current metallic and crystalline circuitry to go "bi", as a result of the widespread use of biochemical and biological circuitry.





USE

The incursion of computers into everyday life will be substantial. Three-quarters of the respondents expect the majority of American homes to have a computer terminal. Eighty percent feel programming will be taught in elementary schools, and just as many think it's a good idea. It may be a necessity. About eighty percent foresee a cashless society, and computer control of most home appliances. Three quarters expect a large computer hobbyist industry.

The majority of respondents do hold some cows perpetually sacred. Only about half expect automatic translators for natural languages, and only 35% expect computer-based data files to replace hard copy books. Eighty-six percent stoutly defend against defiling art and entertainment with the inhuman influence of computers.

SOCIAL IMPACTS

Despite the vast changes expected in technology and computer use, the group was cautious in projecting social change. A minority feel computer based bureaucracies would generate widespread alienation, and only an eighth expected computers to make most government and business decisions. About half think computer and communications industries will dominate the economy, and only a quarter think it desirable. Invasion of privacy is a much debated impact of electronic data systems. Our respondents are sanguine about the outcome of present conflicts, less than a quarter expect fears related to privacy will block the development of data networks.

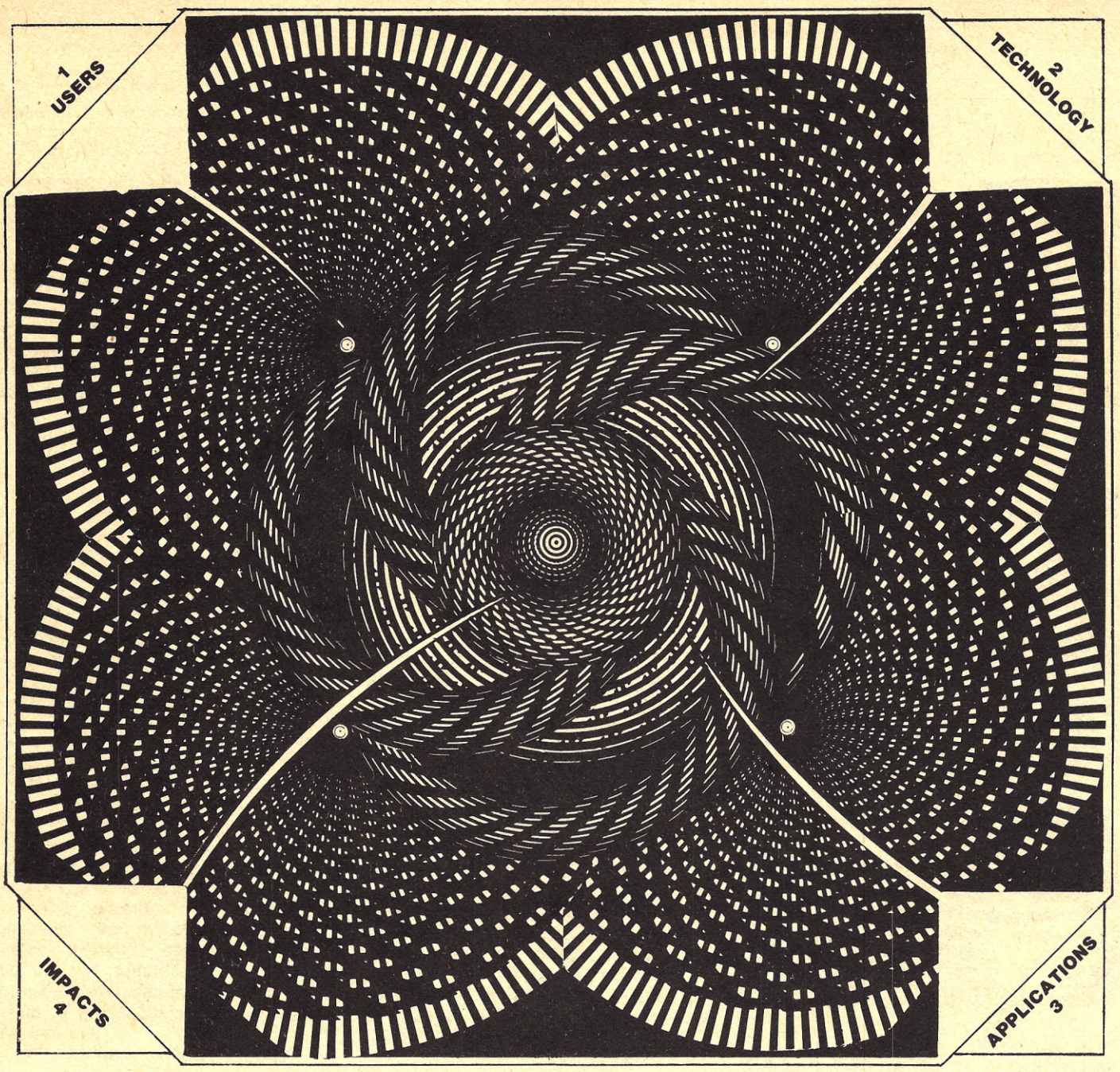
Future developments in computing are not without risks. Nearly half those returning questionnaires thought that breakdowns in computer controlled systems will cause major disasters. Less than 20% expect automation to create widespread unemployment, but less than half expect computer job searches to *reduce* unemployment.

The general picture for the future is not rosy either. Forty percent expect the United States to lose its dominance in world affairs, and only twelve percent think the country can solve problems of poverty, population growth and environmental decay. Fewer still expect world-wide solution to these problems.Less than half expect American quality of life to improve greatly, and only about a third anticipate such a change for the world.

Technology shapes and is shaped by social, economic and political forces. Will computing, perhaps the most fundamental of all technological developments, improve the human lot? Although our respondents are pessimistic, some rays of hope are visible. Over sixty percent expected improvements in health to result from the continuing infusion of computer technology into medicine, and about half think computer data collection and analysis would lead to triumphs in social and environmental sciences.

The problem, it seems, is developing positive strategies within an overall framework of social crisis. The infusion of computer technology into the political process has been suggested as a solution to present problems. However, respondents were cautious about computer based democracy, only forty percent think electronic plebiscite a good idea. Perhaps the concept smacks of the Nielsen ratings, which force choice amongst dismal alternatives. Collaborative effort by scientists (collecting and analyzing data) and artists (focusing public attention and facilitating communication) is more palatable. Over 79% think this development is desirable, and a similar proportion think it important. Unfortunately, only a minority think it likely.

There are limitless ways to interpret the results of a survey. Our purpose here is to challenge our readers and respondents. The future is made, not projected. Computers will play a central role in the next quarter century, and those working at the craft are shaping events to come. This report is meant not to fix the future, but to suggest an image which the tools of computing can help transfigure.



DATA CARTAGRAM

TABLE 1A: AGE

	N	%
Less than - 20	37	14.2
20-29	102	39.0
30-39	83	31.8
40-49	22	8.4
50-59	11	4.2
60-69	4	1.5
70 and Up	2	0.8
Average Age		31.0
Median Age		28.9

TABLE 1B: SEX

	N	%
Male	253	95.8
Female	11	4.2

TABLE 1C: EDUCATION

	N	%
Less than High School Grad.	20	7.6
High School Grad.	10	3.8
Some College	76	28.8
College Grad.	88	33.2
Master's Degree	50	18.9
Doctorate	20	7.5

TABLE 1D: TRAINING IN COMPUTING

	N	%
None	12	4.6
Slight	39	14.8
Significant	94	35.7
Professional Level	118	44.9

TABLE 1D: COMPUTER USAGE IN THE Last Year

	N	%
Rarely (a few times)	36	13.6
Occasionally (once a month)	24	9.1
Frequently (once a week)	62	23.4
Daily	143	54.0

TABLE: 1E: POLITICAL ATTITUDES

	N	%
Very Conservative	13	5.0
Conservative	60	23.0
Middle of Road	81	31.0
Liberal	82	31.4
Very Liberal	25	9.6

TABLE 1F: FEELINGS ABOUT PERSONAL FUTURE

	N	%
Very Pessimistic	3	1.1
Pessimistic	10	3.8
Neutral	25	9.5
Optimistic	155	58.7
Very Optimistic	71	26.9

THE FUTURE OF COMPUTER TECHNOLOGY

	Probability of Event	% Considering Event Likely	% Considering Event Important	% Considering Event Desirable
Costs of computing (costs per instruction executed) will decrease by a factor of 100 from current (1977) levels.	0.84	84.2	80.4	90.5
Costs of computing (cost per instruction executed) will decrease by a factor of 10,000 from current (1977) costs.	0.58	43.4	79.2	85.3
Costs of rapid, randomly-accessible memory (cost per bit accessed) will decrease by a factor of 100 from current (1977) costs.	0.85	85.0	83.8	89.4
Costs of rapid, randomly-accessible memory (cost per bit accessed) will decrease by a factor of 10,000 from current (1977) costs.	0.63	50.6	77.8	87.2
Pocket computers will have independent capacity equal to current "third generation" computers (IBM 360, Burroughs 6500, UNIVAC 1108, etc.)	0.62	50.2	63.0	75.1
Pocket-sized memory units will have capacity equal to contemporary disk memories (will have capacities of approximately 1 billion bits per cubic inch).	0.63	51.3	69.8	79.2
Pocket computers will be capable of automatically linking to computing "nets" (networks) if they are within a mile of a two-way telecommunications channel.	0.66	61.0	58.1	67.9
The majority of U.S. computers will be linked into a general computing/memory network.	0.48	33.2	53.2	38.4
Audio (spoken) communication will be a common input/output mode.	0.80	78.5	58.1	70.9
Holographic (three dimensional) audio/visual output will be in common use.	0.65	55.8	40.3	64.5
Complex interactions with computers will be carried out by a mix of audio communications and movement through a sensor field (programming by song and dance).	0.49	35.1	21.9	25.3
Direct two-way brain/computer (biocybernetic) links will be common.	0.33	19.2	56.6	43.4
Computers which "learn" from experience and are "educated" rather than programmed will be in common use.	0.55	40.8	67.2	62.7
Intelligent, self-aware computers (capable of passing the Turing test) will exist.	0.44	29.1	55.4	40.4
Computers will exist which can comprehend standard intelligence (IQ) tests and score over 200 on them.	0.53	41.8	41.5	36.2
Computer hardware will be largely based on biological and biochemical circuitry.	0.28	9.8	38.1	20.0

THE FUTURE OF COMPUTER APPLICATIONS

	Probability of Event	% Considering Event Likely	% Considering Event Important	% Considering Event Desirable
A very large "computer hobbist" industry will develop.	0.74	69.4	49.8	61.9
The majority of American homes will have a computer console.	0.78	75.8	61.9	69.9
Most major household appliances will contain microcomputers to operate them in home use.	0.84	83.4	50.9	68.3
Almost all financial transactions will be carried out by computer with no physical exchange of money.	0.76	79.3	64.2	49.5
Libraries with "hard copy" (books, etc) will be largely replaced by computer-based data files.	0.51	35.1	52.1	39.2
Basic concepts of computer science will be taught in elementary school.	0.84	83.8	75.5	83.8
Automatic translators for natural (human) languages will be in common use.	0.53	41.2	71.0	80.0
Most art and entertainment will be generated and viewed via computer.	0.32	13.6	19.2	7.5

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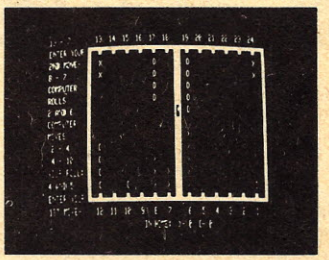

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SOCIAL IMPACTS OF COMPUTING

	Probability of Event	% Considering Event Likely	% Considering Event Important	% Considering Event Desirable
Computer/communications utilities will become the largest industry (in dollar volume of transactions) in the U.S.	0.60	49.5	48.3	26.0
Diffusion of information and authority throughout large computer-based bureaucracies will produce widespread alienation.	0.46	30.9	49.4	4.6
Most governmental and business decisions will be made directly by computer with little human intervention.	0.28	12.8	56.2	9.8
Breakdowns or errors in computer-controlled systems will cause several disasters of serious proportions (resulting in hundreds of deaths or injuries.	0.59	48.3	79.2	3.8
Rapid increase in automation will generate large numbers of unemployed workers.	0.38	18.8	72.8	4.9
Computer-based job-search procedures will reduce unemployment and under-employment.	0.60	47.5	75.5	66.0
The health of the U.S. population will improve because of computer-based diagnostic and health-monitoring techniques.	0.67	62.7	82.3	90.5
Computer-based data gathering and analysis systems will provide the basis for rapid advances in the social and environmental sciences.	0.58	49.0	75.1	73.9
Integrated teams of artists and scientists using computer communications and data-handling will be used to attack major social and environmental problems.	0.54	41.2	70.2	72.8
Most governmental decisions will be made by debate and opinion analysis over a computer network.	0.36	17.3	51.3	38.5
The United States will no longer dominate global economic and political affairs.	0.52	41.2	63.4	18.8
Problems of poverty, population growth and environmental decay will be largely solved for the United States.	0.30	12.0	89.2	90.9
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The overall quality of life for the average American will be greatly improved.	0.57	41.2	80.0	89.4
The overall quality of life for the average human will be greatly improved.	0.48	34.4	86.4	92.8
Fear of invasion of privacy and general technical and economic problems will prevent the development of large data "nets" (networks).	0.41	23.8	53.5	23.0

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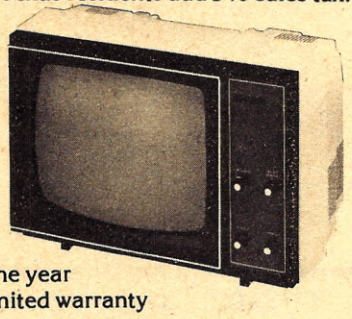

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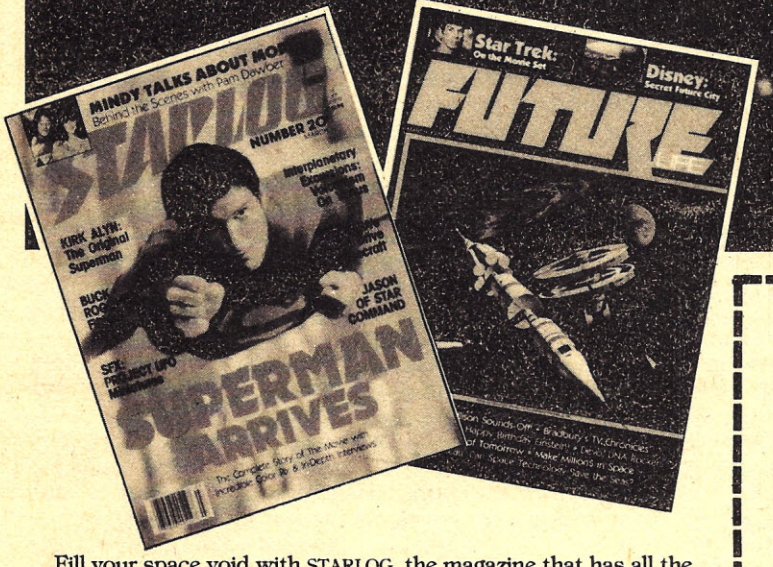

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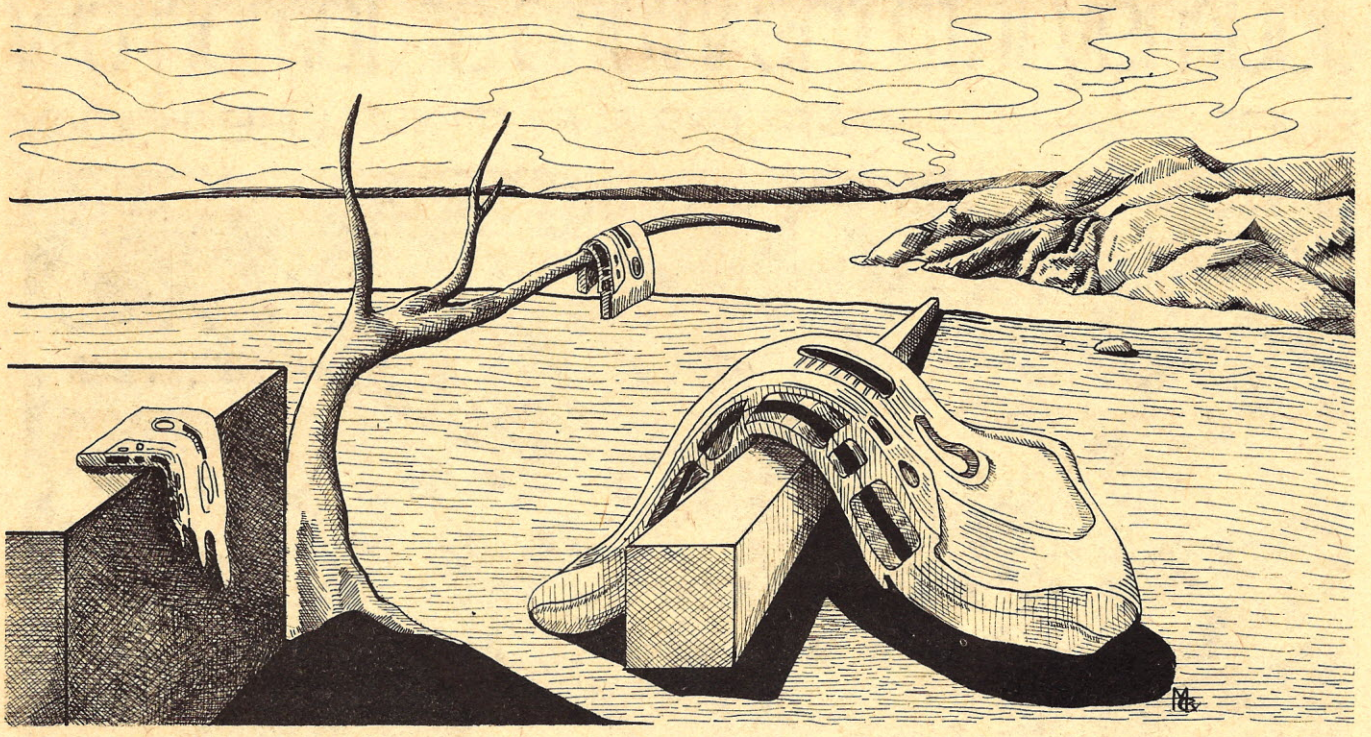

Randy Heuer

Math I Program, Radio Shack Software (26-1701), $19.95.

This is a basic math instruction program system for a Level-I system with 4k of memory. Three tapes are provided; one for learning addition & subtraction concepts, one for learning multiplication & division concepts, and the final tape has a series of quizzes to test the student's progress. Each tape contains the listed program, recorded twice on each side. I had no problems in loading any of the tapes.

The instruction method used is similar on both the addition/subtraction and the multiplication/division tape. The basic procedure consists of four sections. For each section, the student is required to correctly complete the section, otherwise he will be required to do that section over again. Upon completing each section correctly, a rocket flies up the screen through a "VERY GOOD!" sign, and the program proceeds to the next section.

In the first section, the student is presented with four related math problems and their solutions (called fact sets), and is told to say the problems out loud. Next the four problems are reprinted, without answers below the answered problems, and the student is required to enter the correct answers from the keyboard. Then the four problems are again reprinted, this time in an order different than that printed above, and the student then enters the correct answers. In the final section, the problems are reprinted, this time without the answered problems above them, and the student then enters the correct answers. This four-section procedure is then repeated with four new problems, and finally all eight problems are combined for the student to answer. This entire procedure is called a group, and there are 23 addition/subtraction and 23 multiplication/division groups on the two learning tapes.

The accompanying manual is written primarily for the teacher or parent. It explains the concepts of the teaching technique, and suggests when the third evaluation tape should be used to test the student's performance. The evaluation program gives the student 16 problems at his level, and requires him to answer them with no assistance. Based on the student's ability to solve these problems, the student is advised either to review previous groups or proceed to the next.

In general, this is an excellent package, similar to, but better than the flash card approach to teaching elementary math. It could be used as a supplement to formal math education, or as a tool for the above average student to explore new areas.

Algebra I Program, Radio Shack Software (26-1702), $19.95.

This three tape package is designed to run on a 4k, Level-I system. Each tape contains two lessons, recorded twice on each side, for a total of six lessons. Each lesson presents a portion of a typical algebra course such as equations of one variable, real numbers, factoring, etc.

Unfortunately, this system fails to accomplish what a good algebra I book does, and this is not surprising. It just is not possible to put as much information in six computer lessons as in a text. Instead, the program package attempts to present a number of concepts or definitions on the screen at one time. This certainly has to be confusing to the student trying to learn algebra for the first time. As a supplemental program, however, it has considerably more merit.

But we found that in the areas where the computer could be most helpful, this package also falls short of its possibilities. In a few cases, the student cannot progress into further sections without successfully answering the problems. However for most of the problems the student must answer, the computer will accept any answer, and then tells the student the correct answer. This procedure lets the less motivated student fail to fully understand his mistakes.

In summary, this package is not ideally suited for the new Algebra I student due to the compressed nature of the package. The Algebra I package is better suited for the individual who wishes to review previously learned material, or as a supplement to a standard algebra course. ■

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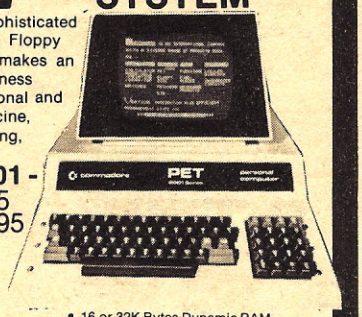

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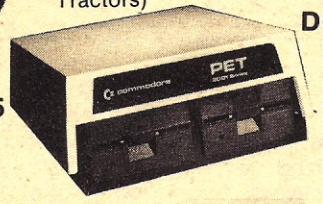

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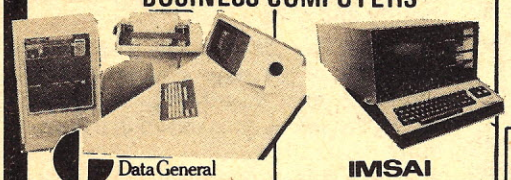

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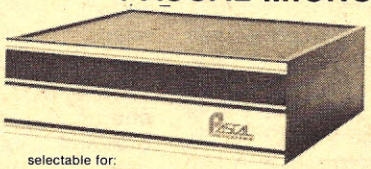

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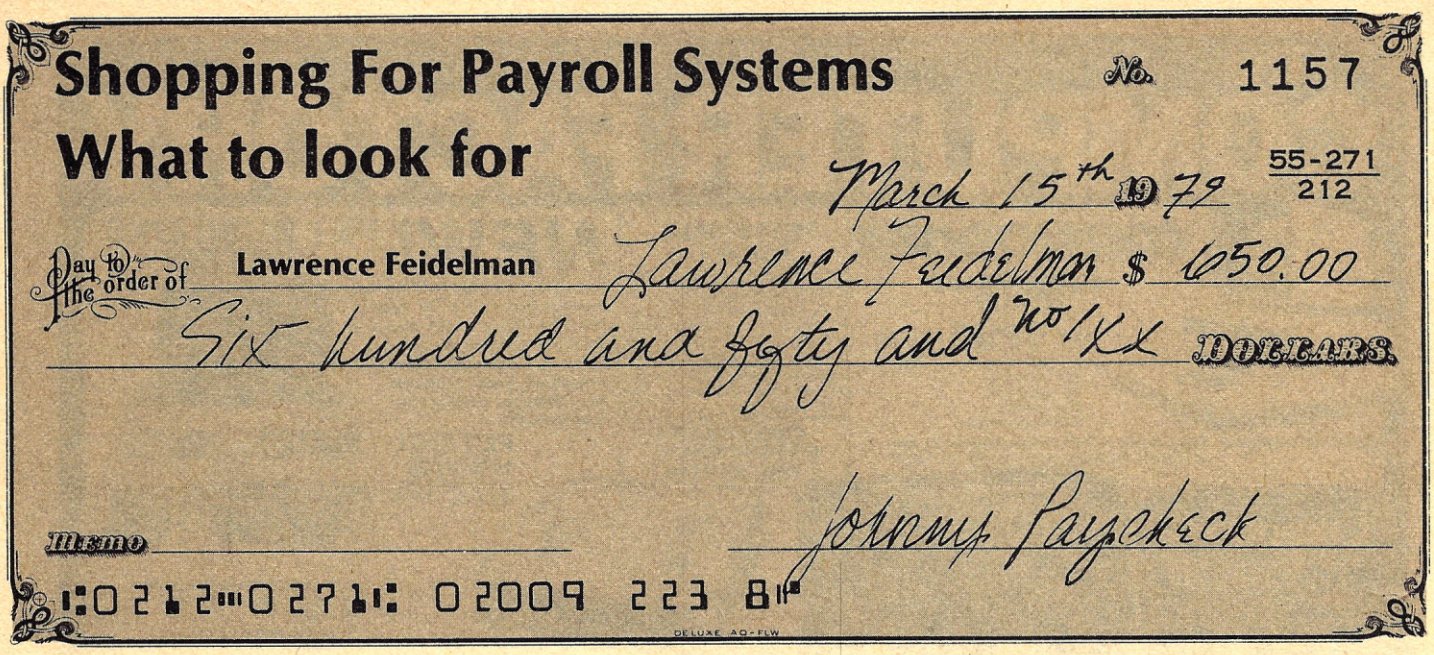
Shopping For Payroll Systems
What to look for



There are very likely a lot of considerations you aren't aware of that you should be when shopping for a payroll package for your business system.

Introduction

The importance of the payroll application to a company depends heavily on the nature of the business itself. In the case of the manufacturing company, computerization of payroll is generally a more important consideration than with a wholesaler or distributor, due to the number of employees, as well as to input to management labor production reports. Whatever your type of business, and even if your payroll is small in numbers (e.g., 15 or 20 up to 45 to 60), payroll should still be viewed as a possible application for your small business computer. Not only is time saved every week, but at month's end, quarter's end, and at year's end as well. What must be considered is: How expensive is the payroll? Is it simple enough to set up and run? Will it save time over manual methods? What labor data must be entered into the system for obtaining accurate management reports?

Look at Your Requirements

When the decision is made to computerize payroll, you must consider exactly what the package should do for you to be really beneficial. For example, piece work and other incentive bonus payroll requirements may not really be a good approach. Where extensive labor distribution is required, such as with a contractor in job cost accounting, a specialized module may be needed to handle these requirements. There are many payroll package systems available that do handle these requirements, but *you* must know what you need.

For those users whose payroll requirements are less complex, standard ized payroll packages will almost always work well. Some payroll packages work on an exception basis and only require entry when an unusual condition occurs. This situation works well in a heavily salary-only-oriented environment, or where number of hours worked in an hourly environment do not vary significantly.

Do not become concerned with extensive cost center and department breakouts of labor costs unless these can be made useful. This type of good management reporting capability is excellent, but is cumbersome if not used.

It may be Free

Look at the cost of the software charge for payroll. Some industry-oriented total software packages include payroll as part of the over-all package. In fact, excluding the payroll module may not result in any appreciable savings. (It is wise in any software package purchase to determine the price of all the elements then the price of a subset.) Complete packages that include payroll may make automation of even a 15 person payroll worthwhile.

Best Time for Conversion

The end of the year is always the best time to convert to computerized payroll. Quarter end is the second best. This is because most firms at least balance payroll quarterly. If some mechanized payroll method or service bureau is being utilized, conversion other than at these times may be impossible.

What Should It Have?

There are some basic payroll needs that should be considered once the payroll function is definitely going to be automated.

Specifically, some of the following items should be considered:

1. How easy are the conversion tools and the plan to make sure everything is in balance?
2. What is the mode of entry: keyboard, punched cards, tapes, cassette, etc.?
   a. payroll generally does not require on-line capabilities for its preparation.
3. What type of data security is provided? (This could be a touchy issue with payroll.)
4. Will the system handle salary and hourly and mixed situations?
5. Will it handle and do you require mixtures of weekly, biweekly, semi-monthly, and monthly paid people? Can all types be processed in the same run?
6. Can salaried people be prorated in some fashion if departmental charging is desired?
7. Can the system handle payroll for multiple locations and multiple companies? Will separate reports be produced?
8. How difficult is the charging of hours and dollars to cost centers and departments?

9. Does it handle all local taxing requirements, which includes none or partial taxing?

10. Can it handle various types of deducting (e.g., one time, fixed rate with cut off).

11. Check for the mundane but necessary requirements of error correction, reversals, prepays, etc.

12. The audit trail to search back from the finished product to its source must be trackable. Files must allow reference to each pay entry. Remember state and federal auditors will require this. Do not give this up.

13. The system should give the user flexibility. It is desirable to be able to change withholding rates, FICA rates, state tax rates, local rates, etc., without requiring program background or vendor assistance. This can be built into systems, but some vendors overlook it.

14. Processing of payroll is generally a sequential operation, done in the same order every week. Ask what happens to entry files if the payroll operation is aborted for any reason? The worst that should happen is just rerunning the job from the beginning.

15. Complete earnings and deduction journals are expected.

Reporting Capabilities

Payroll reporting requirements will vary greatly depending on the nature of the business. However, the minimum expected from the system includes summary totals of all earnings, hours etc., types of earnings such as vacation and sick pay, as well as summary totals for all deductions. Quarterly 941A and state reports should also be part of the system. Year end W-2's are a must. There are very few payroll packages that do not include these reports.

A monthly check reconciliation is a useful tool in reconciling payroll accounts. This would be expected from any disc oriented small business computer.

The Extras

As mentioned, many other types of detailed and summary reports are available to you. Some come standard with payroll packages. The secret is to determine what is really going to be useful to you. Some of these reports can be quite useful. Would labor costs by department allow you to make any modifications to the way you now utilize personnel? Would the maintenance of detailed personnel records be useful? In strongly unionized environments and heavily regulated industries, this may not only be useful but required.

Summary

As in the case with any other computerized system, payroll can be the simple mechanization of a clerical function, or more importantly, the transformation into a management tool. The payroll program can not only be utilized for keeping track of costs, but for projecting costs as well. We once examined a program set up as an addition to payroll writing and record maintenance that allowed school directors to place the specifications of a teacher contract offer into the system. The system was designed to thoroughly analyze the teacher personnel file. Since teachers' pay is based on years' service, degree attained, etc., the computer system was able to project accurately how much the contract-offered package would cost the school district. They could then determine whether the school district could afford this settlement, based on the anticipated tax base.

Payroll can indeed be a management tool. ■

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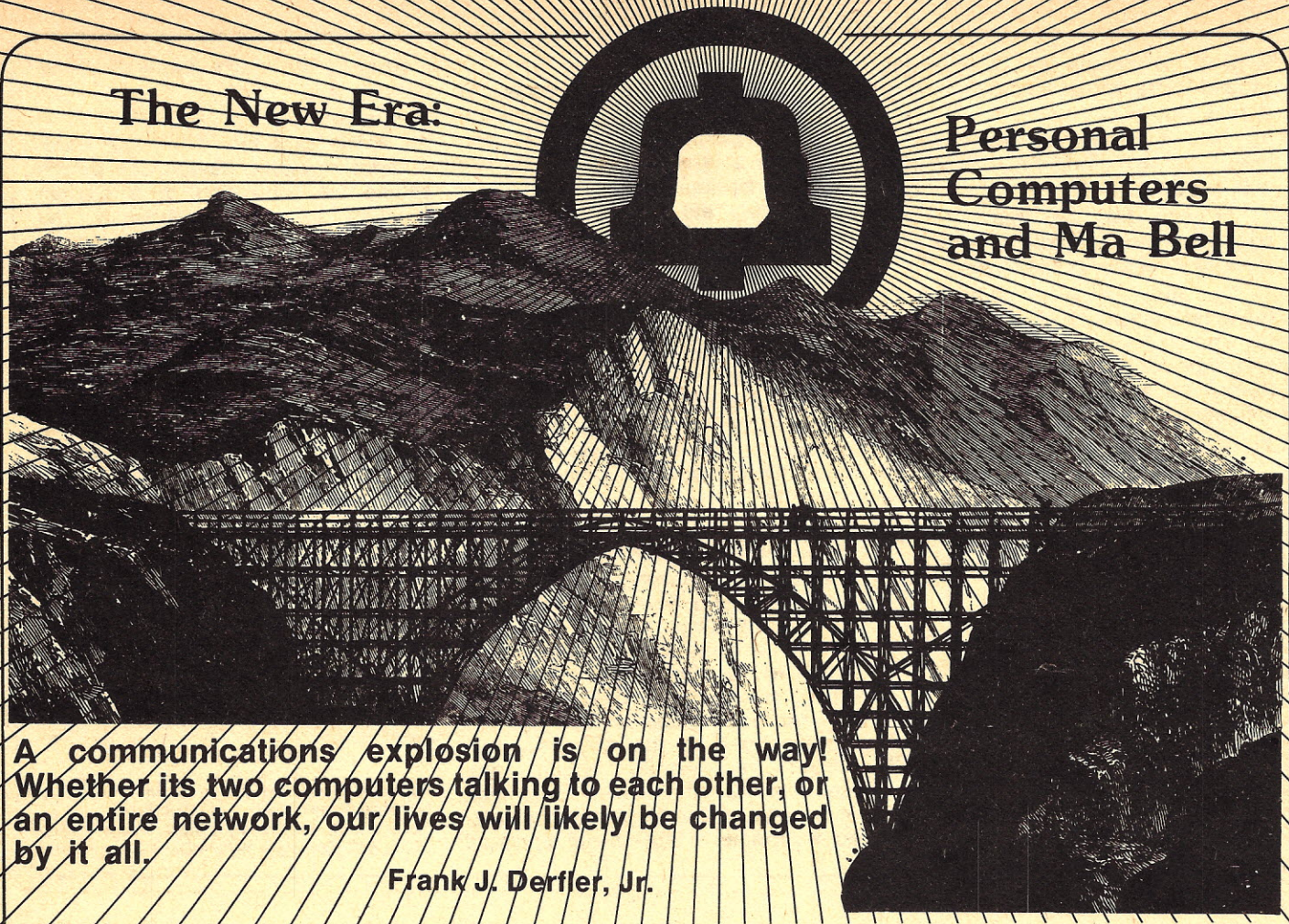

A communications explosion is on the way! Whether its two computers talking to each other, or an entire network, our lives will likely be changed by it all.

Frank J. Derfler, Jr.

Jerry had his long frame stretched out comfortably on the front porch. It was a quiet evening and the sun was getting red in the west. He put down the magazine he was reading and reached for a small push-to-talk microphone on the table beside him. Pressing the switch on the microphone he said, "Porch light on." A microsecond later, a light attached to the hammock above his head sprang to life. He settled back to read when suddenly the light went out. Wearing a puzzled expression, he checked the switch on the lamp and the connection of the lamp into the wall socket. He picked up the microphone again and repeated the same command he had spoken before. Only this time, instead of the light coming on, a female voice floated down from the open second floor window which said, "Hey lazy, turn the light on yourself!"

"Terry!" Jerry shouted exasperatedly, "What are you doing with the computer?"

"Come up and see!" was the response that floated down.

Jerry's long legs carried him inside and up the stairs in a couple of strides. He entered a large room that was a combination workshop, library, computer room, hamshack and family den.

Frank J. Derfler, Jr., 99-1440 Aiea Hts. Dr. #25, Aiea, HI 96701.

Terri, his 17 year old sister, was seated in front of a keyboard attached to a Poly 88 computer.

"Hey, leggo my Poly!" Jerry complained. Actually, he was happy to see her using the computer system, but he couldn't let her willful appropriation go unnoticed. He saw that she had SCRATCHED his AC controller program and had loaded a disc containing the family address book.

"I'm looking for Amy's address at college. Dad's using the Horizon, so I borrowed your little orange toaster." As she spoke, Terri typed in Amy's last name and the computer displayed the complete address. She typed a "control P" and a number of selonoids began banging away on the keys of an old but serviceable electric typewriter in the corner. The address appeared neatly typed on the envelope that had been rolled into the machine.

"Amazing! The popcorn popper worked again," she exclaimed.

Jerry winced. His sister's pet names for each piece of electronic hardware were based on some attribute like shape, size, or sound, but he didn't appreciate the popcorn popper description of his home converted printer. Ever since he and his father, a physics teacher at the local high school, had built the Poly 88 it had been dubbed "the toaster" because of it's long narrow shape. The selonoids on the typewriter did operate with a certain amount of noise, but Terri never had developed an appreciation for the beauty of hardware. She was a good programmer though. She was better than even their father at using random files and at programming in machine language, but to her the computer was just an appliance that did what it was told.

Jerry had literally cut his teeth on transistors and grown up with integrated circuits. He had his general class amateur radio license when he was 12 and his advanced class license by 14. He and his father shared the ham rig that occupied one wall of the room. To him, software was a kind of necessary evil.

"Jerry, when you go away to school this fall, are you going to write us or what?" Terri asked.

"Or what, I guess," he replied. "Dad and I have talked about it and at first we thought I could take a ham radio rig and keep weekly schedules with the family. But after our visit to the dormitory last month, it doesn't look too good. I'd have to make do with an indoor antenna. The place is loaded with stereo and audio gear my signal could get into, and the interference from razors and hair dryers is fierce. Three strikes I guess, but you know

how I hate to write. We are looking for a ham there in town who would let me use his rig, but I don't know..."

"Take your popcorn popper," she volunteered. "It's so loud you could send Morse code with it and they would hear the sound 40 miles away." With a wicked smile and a bound she was down the stairs and headed for the mailbox.

Jerry sat down and put his feet up on the desk. He had already intended to take the whole Poly system to school with him. After the family had gotten the Horizon II the Poly had officialy become his. It could do decent word processing and they had some good education programs for drilling and memorizing facts such as scientific terms and people or dates in history, but he hadn't considered the communications aspects before. He reached for a piece of paper and began doodling a block diagram.

One afternoon about two weeks later, Terri returned from a set of tennis to find Jerry waiting for her on the porch steps. "How's your two-handed serve?" he asked.

"OK, Jerry," she said. "I know the only service you are interested in is in a restaurant. What do you want?"

"I need a little programming advice," he admitted.

"All right, Mr. Hardware Magician, give me a few minutes to clean up."

When Terri entered the computer room, she saw that things had been rearranged. Next to the Poly 88 was a small box with a telephone cradle on it, a telephone answering machine, and some test equipment. The whole thing seemed to be stuck together and bound up with clip leads.

"Ugh!" Terri sniffed. "Another haywire contraption."

"Not too bad really, Sis." Jerry said patiently. "You gave me the idea when you told me to take the printer to school. I had intended to take the whole system anyway, but you started me thinking about using it to communicate back home. Computer to computer communications has a lot of advantages. I can place a very short phone call when the rates are low. Likewise you can send me a lot of information in just a few seconds including any programs or data you have here. So I started to think about ways of communicating. The cassette interface is audio and the phone lines are audio, so the simplest thing to do seemed to be to pump the cassette audio down the phone lines directly. I used this ham radio phone patch to couple the audio. It separates the phone line into the send pair and receive pair that the cassette interface needs. I tried it, but it wouldn't work over any distance. I guess there must be too much phase delay between the two tones the cassette interface uses when they travel over long unequalized lines.

"That leaves me with the RS-232 ports on the Poly and the Horizon as the best means of communicating. But if I use RS-232, then I'll need modems."

"A modem converts the RS-232 signal into audio tones that can go over a phone line, right?" Terri asked.

"Right. The tones a modem uses are not critical and they can be passed over noisy or distorting phone lines and still be understood. But modems aren't cheap. The Pennywhistle here," he indicated the box with the telephone coupler on top, "is about the most economical at $130 for the kit."

"I begin to understand," she said tapping a pearly front tooth with a long fingernail. "You now have a way to put RS-232 into one end of the phone and get RS-232 out the other end, but you don't quite know what to do with it when you get it there, do you?"

"That's about it," he admitted.

"I think I followed you most of the way Jerry, but why not just send a

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letter?" she asked half seriously.

"Computer mail is the wave of the future Terri. We have the equipment and we may as well use it. Besides, think of all the information I'll have for my computer science courses. Why with a little expansion this lash-up alone could provide me with research paper topics for all four years of school!"

"Oh," she groaned, "I knew there had to be some lazy man's answer in there somewhere. Well, let me see what kind of a program I can come up with to recognize your little messages. How do you plan to use the system anyway?"

"As I said, I'll call in when the rates are low. Our computer isn't on all the time and we can't afford to have dedicated phone lines, so the best thing to do is for me to call in and have somebody record the tones from my modem on a cassette recorder connected to the phone line through the phone patch. Then you or Dad can play that tape back into your modem and load it into the Horizon. When the family wants to respond, you can put notes into a file as you think of them. The beauty of this sytem is that you can send me software too. You just call my dorm room. If I'm there, I'll record the data. If I'm not, then the telephone answering machine I salvaged from the junk heap last year will do it for me."

"This would be a good way of setting up hobby computer networks," Terri observed. "Most hobby computer users don't need real time communications anyway. Audio recording gives the advantages of a dial up with only a little wait for a response and a lot less cost. Much less software hassle too. If you want to keep the software really simple, and I know you do, just type your notes or comments AUTO numbering feature in BASIC makes that easy. Then we'll just enter it, LIST and read it off. Don't try to RUN it though!"

A week or so later, after another modem kit had been built, all had been prepared for the system smoke test. Jerry took his Poly 88, a modem, the telephone answering machine and all of the other paraphernalia to a friend's house across town. After connecting the modified answering machine/-recorder to his friend's phone, Jerry called his home. His father answered and said, "OK Son, the recorder is running. Send your data." Jerry had a program of words in RAM that he played into the phone line through the modem. After it had stopped, his father said, "Hang on and I'll see what we got."

In a few moments Jerry heard his father laugh and he knew the transmission had been a success. The terminal attached to his father's Horizon computer had printed out:

or whatever as program lines with a number in front of each one. The

```
10 REM Hi everybody! This is a test
       of the
20 REM kind of messages I will be
       sending from
30 REM school. Please send money.
       — Jerry
```

When it was his turn to receive, Jerry had his father call him. The telephone answering machine picked up the line and gave its short pre-recorded announcement. Then Jerry heard a stream of data coming into the recorder. When it was done, he rewound the tape, changed a few jacks, and loaded the tape into the computer through the modem. His father's reply was:

```
10 REM Son, thank you for the nice
       note.
20 REM In response to your request,
       I can only
30 REM say: Send your report card!
40 REM Data table follows:
50 REM    A=$50
60 REM    B=$25
70 REM    C=$ 5
80 REM    D= YOU OWE ME
90 REM Please re-submit request
       when
100REMcomplete data is available
       — Dad
```

"Oh no!" Jerry groaned. "I wanted electronic mail, but I wound up with a drive-in teller instead!" ■

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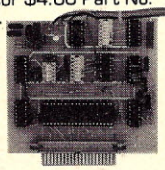

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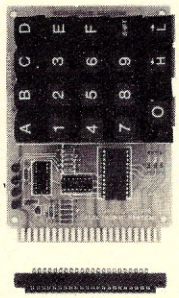

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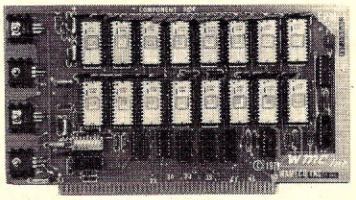

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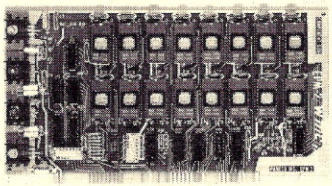

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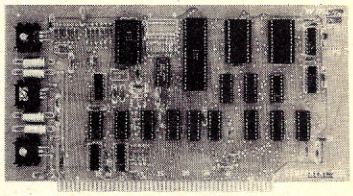

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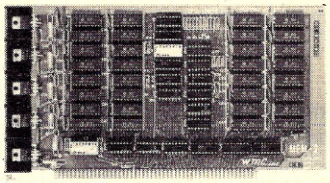

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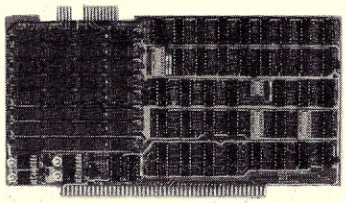

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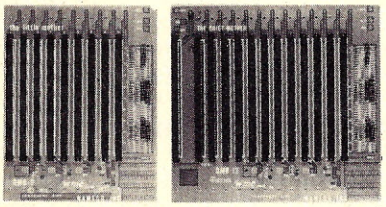

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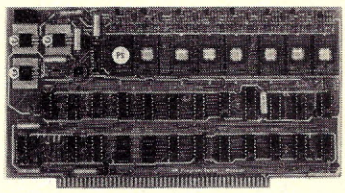

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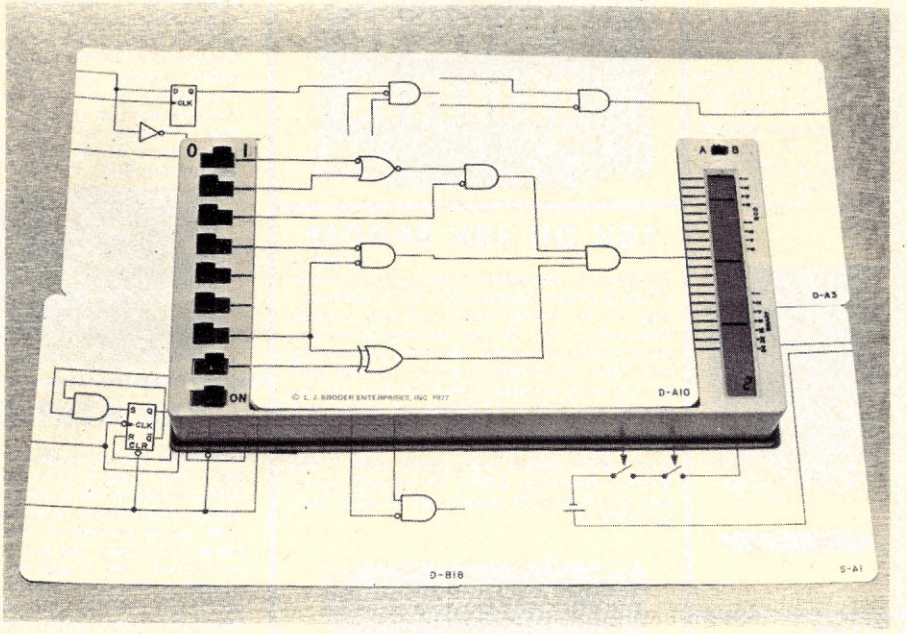
CIRCLE 118 ON READER SERVICE CARD

A Different Teaching Aid: The Broder Logic Trainer



John Craig

I was an instructor for several years before I became a magazine editor. I've taught courses in digital logic and wished, on many occasions, that I had a logic trainer (or trainers) to supplement the course material. At one point I even started to build a trainer for use up in front of the class. It never got finished. At another point I checked into the cost of some trainers ... and was shot down on that before I could even get a purchase order written up.

Naturally, the most desirable situation would be to have a digital trainer for each and every student. Notice that I said "digital trainer." For the purpose of this review perhaps we should distinguish between a digital trainer and a logic trainer. Let's consider a digital trainer as one which has the capability of giving the student actual exercises in using digital integrated circuits. The Broder Trainer, which we're looking at here, is a logic trainer — one which provides exercises in analyzing and interpreting logic diagrams. The student must be able to understand the diagrams before getting into the circuits. Now, the question is, is the Broder Logic Trainer a viable means of achieving this goal?

At first glance, I felt the unit might be somewhat limited in the number of exercises available. After going over those exercises I've changed my mind. There are a total of 52 ... 20 sequential logic problems (gates) and 20 combinational (flip-flops and gates) and 12 miscellaneous. The inclusion of those 40 exercises as supplementary material in a digital logic class should add a lot to the course. The trainer would be ideal for homework assignments and lab exercises in the beginning of the course (when learning how to interpret logic diagrams is being taught). It's even conceivable that the Broder trainer could be used for the entire semester. However, I feel the most value would be obtained by using it to supplement actual lab exercises with a digital trainer. The logic trainer for teaching logic diagram interpretation ... the digital trainer for "real-world" building and troubleshooting of logic circuits. There's no way that I can see the Broder trainer replacing a digital trainer. But ... if the school doesn't have digital trainers the Broder would be even more significant (because of what it could accomplish by itself).

The operation of the unit is straightforward and enjoyable to anyone challenged by logic exercises. A card with the circuit to be analyzed is placed in the middle of the trainer. The switches on the left are used to set the logic "1" or "0" levels into the circuit and the liquid crystal display on the right indicates the output. (The on/off state of the display at the output of the gate is the only one of interest ... the others are disregarded.) The student places a piece of clear plastic over the circuit and can use a grease pencil to go through and indicate the logic levels at the inputs and outputs of the gates. When working with the clocked logic exercises (flip-flops) a counter in the lower right-hand corner keeps track of the number of clock pulses. The unit can also be used for introduction to binary counting (see far right-hand side) and BCD counting.

As I mentioned before, I believe the Broder Logic Trainer would make a valuable contribution in supplementing a course in digital electronics. The student still needs to have access to, and use, a digital trainer for building circuits, seeing the waveforms on an oscilloscope, getting familiar with IC specs, worst-case conditions and troubleshooting. In the beginning stages the student needs to concentrate on learning to interpret logic diagrams ... not wire up a circuit. I wouldn't mind teaching a course using the unit. I believe it would do the trick in meeting those objectives.

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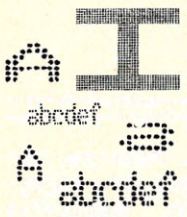

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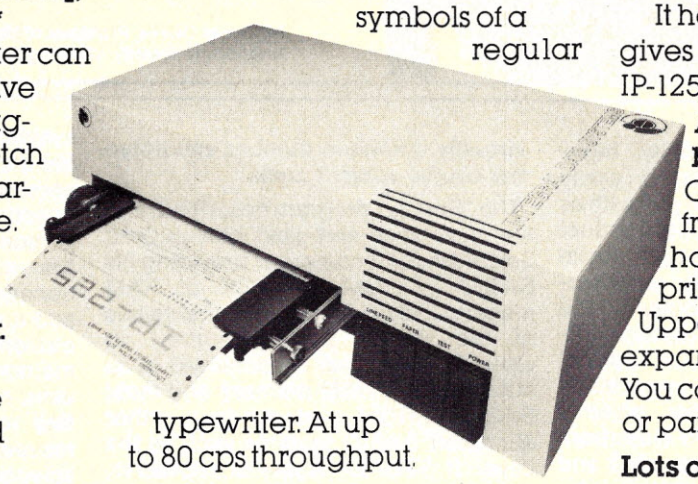

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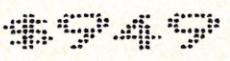

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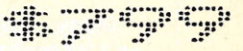

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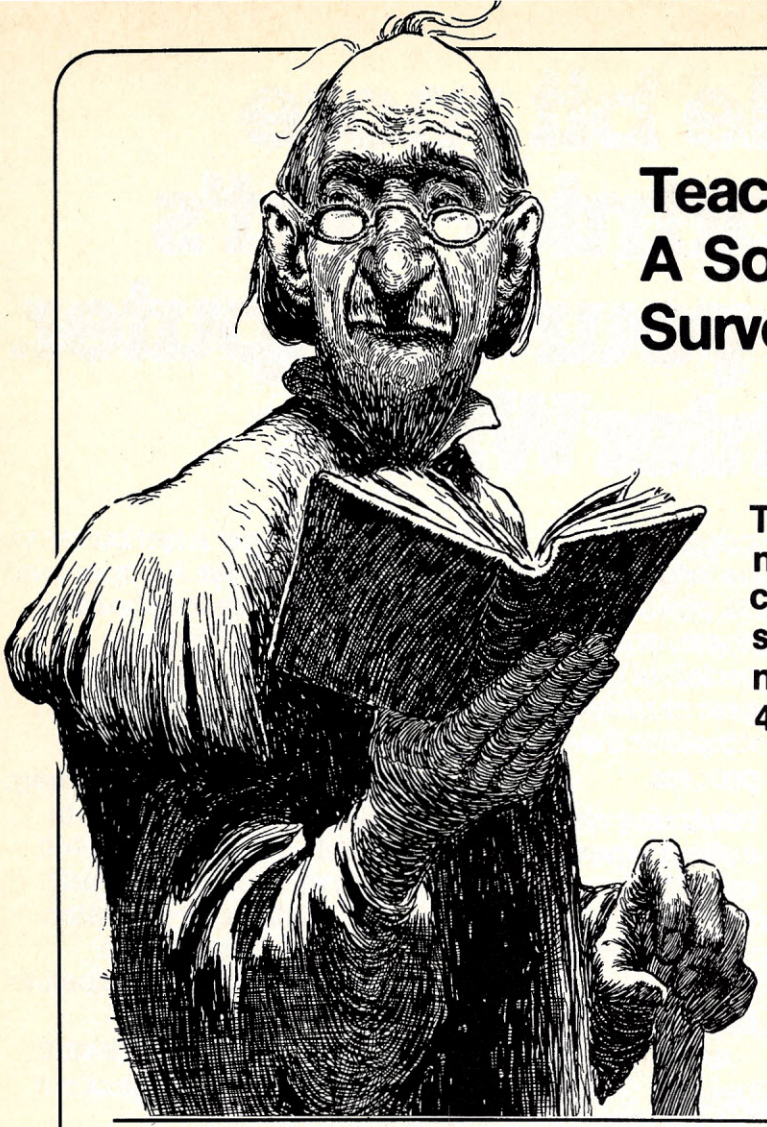
CIRCLE 145 ON READER SERVICE CARD



Teachers! A Social Science Survey Program!

Dr. James Owens

This program will add a whole new dimension to social science classes . . . from elementary school to college! All you need is an inexpensive 4K microcomputer.

Dr. James Owens, Professor of Management, The American University, Washington, D.C.

Many teachers, especially high-school and college teachers, can easily use a small computer (even one with as little as 4K of RAM memory) to conduct and process professional-type social science surveys. Obviously, such surveys and studies contribute to the teacher's research, and publication-record in the "publish or perish" academic world. More importantly (and interestingly), social science surveys of a teacher's own classroom students, when quickly tabulated and processed, provide rich material for enhancing and making *relevant* course topics. For example, the function of the Social Security program in the USA can be rescued from dull abstraction in classroom lectures by a survey question forcing the student to record his own opinion and discuss it within the context of the tabulated opinions and statistical conclusions of the class population as a whole. The same is true for a multitude of other routine high-school and college course topics such as the ERA amendment, function of taxation in the USA, corporation profits, political voting patterns and more. Such classroom applications are virtually infinite in number and potential course subject areas.

The "Survey" program described here was developed and used with an Ohio Scientific 6502 computer providing 8K BASIC in ROM and 20K of RAM memory. However, the essential values of the "social science survey" in classroom use can be achieved in as little as 4K of RAM memory and most BASIC-IN-ROM systems (e.g., other Microsoft BASIC systems such as the Level II TRS-80, Apple II, Sorcerer, PET).

The Questionnaire

The program permits a highly refined graduation of questionnaire responses ranging from *very strong* agreement to *very strong* disagreement with all items on the questionnaire (including provision for "no opinion" responses). Figure 1 presents the basic format of such a questionnaire. The program here dimensions fifty rows for fifty questions or fewer. Depending on memory available, the program can process about forty full DATA lines, including 1K of memory for the RUN, within the contraints of a typical 4K RAM memory system. A 4K system, therefore, can handle a survey of, for example, a forty-person sample with twenty-five questions in the questionnaire, a 100-person sample with ten questions in the questionnaire, or any proportionate combination of sample number and question number between the two extremes exampled. Conserving memory, as this program does, any user, restricted to 4K of RAM, will still find room in memory for very useful research or classroom-oriented social science survey projects. It should be noted that a large survey, for example a 100-person sample with 50 questions in the questionnaire, will require about 20K of RAM.

The Video Display—or Output—of the Program

The program generates for each row of output-information (each row being equivalent to a particular question in the questionnaire) a full twenty-one "columns" of calculated values. Since, however, it would be a rare conventional page of paper or computer video screen that could list twenty-one horizontal columns, the programmer has the choice of arraying the columns

closely (using a ';') or vertically (using no punctuation at all in the Line 490 PRINT statement) or, as used in this program, completing the PRINT statement with a comma. Only the latter programming tactic emerges as useful in terms of esthetics, styling and *readability* — and, thus, is used here. The "comma," ending Line 490, produces for each Question/Item number an easily readable and systematically consistent array of 'columns' in five vertical rows as illustrated in Figure 2. Use of the full twenty-one 'columns' permits calculation output of professional-type values such as standard deviation for the sample total as well as internal sample elements such as "males" vs "females" or "age 30 or over" vs "age 29 or under." Most importantly, calculations of the standard error of the difference between "means" (such as between the mean for Males and the mean for Females or the mean for those over age 30 vs those under age 29) become possible — as well as reports on the "significance of the difference between means" (as in Figure 2 columns #18 and #20). Note: Many users of this program may not need, or want, all of the calculations-results produced in the RUN output; in which case, unwanted lines can easily be deleted from the program. Also, the 21-column output display formatted as in Figure 2 requires a video display of 64 characters per line available with many small systems such as Radio Shack's TRS-80, OSI's C2 Challenger series of systems and others; if your system provides fewer than 64 characters/line display, a semi-colon — or no punctuation at all — at the end of line 490 will position the twenty-one columns in a more readable format than the comma used in the program here.

Just prior to the video display of the first question (as in Figure 2), the program generates a display summarizing the sample and its subsamples, as follows:

```
Total Sample    = 9
Total Males     = 4 Total Females = 5
Total Age 30+   = 5 Total Age 29-  = 4
```

The Program Methodology and Documentation

An explicit goal of the program development was to economize memory use to a minimum. One main method was, of course, to eliminate all documentation (REM statements) from the program lines. That documentation will, therefore, be presented here in line-order by line number (or groups of lines).

Line 10 rounds off all decimals to two only for purposes of readability. Without this function the video display becomes overcrowded with useless decimal expressions of six or more digits (such as 4.2247653). The "FNH" in 490 implements the function.

Line 20 dimensions an array of fifty rows, each row consisting of twenty-one columns. As mentioned above, each row (1,2,3 etc.) represents a single, particular survey question identified by the same question number and row number (thus, Row 1's displayed calculations display the calculated results for Question 1 of the survey, as in Figure 2). Remember, too, that within each row, as displayed on the video screen, the row's twenty-one columns are themselves formatted into five vertical elements ("rows" within

Figure 1. Typical questionnaire form.

Directions: Please enter in the column at the right a number from "1" to "9" for each question/item indicating your degree of agreement or disagreement on the 1-9 scale where:

1 = "I disagree very strongly."
2 = "I disagree strongly."
3 = "I disagree substantially."
4 = "I disagree slightly."
5 = "No Opinion or Preference"
6 = "I agree slightly."
7 = "I agree substantially."
8 = "I agree strongly."
9 = "I agree very strongly."

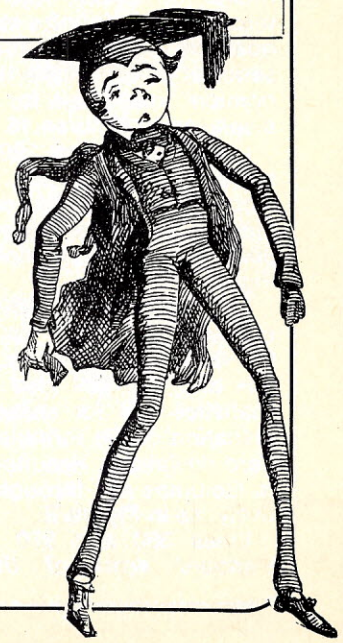
For Reference please check appropriate categories: Male ✓ Female
Age 30 or over ✓ Age 29 or under

#	QUESTION/ITEMS	Enter 1-9 in this Column
1.	The Social Security System, including premiums and payments, should be abolished.	✓
2.	The "ERA" amendment should be ratified and become law.	2
3.	All taxes, including Federal and State income taxes, should be decreased.	8
4.	Etc.	

Figure 2. Illustration of typical video display of calculations (question #1 is illustrated). Note: In the actual video display generated by the program the column numbers and descriptions above are deleted (to conserve memory) and only the calculated values are printed. See Figure 3 for actual video display output.

Column # 1 Question #	Column # 2 Males' Score	Column # 3 Females' Score	Column # 4 Age 30+ Score	Column #5 29- Score
1	21	17	12	26
Column # 6 Mean for Total Sample	**Column # 7 Mean for Males**	**Column # 8 Mean for Females**	**Column # 9 Mean for 30+**	**Column #10 Mean for 29-**
4.22	5.25	3.4	2.4	6.5
Column # 11 Standard Deviation for Total Sample	**Column # 12 Standard Deviation for Males**	**Column # 13 Standard Deviation for Females**	**Column # 14 Standard Deviation 30+**	**Column#15 StandardDeviation 29-**
2.44	2.68	1.85	1.5	1.12
Column # 16 Number of "No Opinion"	**Column # 17 Standard Error of the Difference between the Male vs Female Means**	**Column # 18 Significance of the M/F Difference (3 = 99% level of confidence)**	**Column # 19 Standard Error of Difference between 30+ vs 29- Means**	**Column#20 Significance of 30+/29- Difference**
2	1.58	1.17	.87	4.7
Column # 21 % of "No Opinion				
.22				

Note: In the actual video display generated by the program the column numbers and descriptions above are deleted (to conserve RAM memory) and only the calculated values in the order above are printed. See figure 3 for actual numerical video display output for Question/items #2 and 3.



the basic Row) and five horizontal columns (Figure 2).

Lines 30 to 80 enter the row (or question) number, from 1 to 50, into the first column of each row and set all twenty remaining columns for each row at zero.

Lines 90 to 230 place survey responses (numerical values) into Columns 2,3,4 and 5 for each question (row). The variable P reads either a 2 or a 3 (2 = Male, 3 = Female) from the first DATA entry in each DATA line (Line 901) and keeps a count of total males and females; the variable R does the same count for respondents aged 30 and over vs those aged 29 and under (30+ vs 29-) as read from the second datum from each line (every data line representing one individual respondent). The variable R reads either a 4 or a 5 (4 = age 30+, 5 = age 29-). Although obvious, it may be of interest to many readers that the P and R variables can be used, *with no structural change in the program*, to record and calculate a variety of "categories" such as smokers vs non-smokers, liberal vs conservatives, Protestants vs non-Protestants, Yankee baseball fans vs their opposite and so on. Also, if only a single discrimination of sample categories is needed, or none at all, then simply eliminate the program lines which involve the P variable and the R variable respectively. Line 95 registers dummy data to move the program toward its end. Lines 180 and 210 calculate and total the sums of squared values needed for the later standard deviation calculation and store these temporarily in Columns 17 and 20. After the standard deviation calculations are completed, and the sums of the squared values no longer relevant, Columns 17 through 20 are "erased" and used to record, and display, meaningful values as in the Figure 2 format. Although a bit intricate, or "tricky," the loops in 170 through 220 minimize memory use by quantum proportions as compared to a series of GOTO's. Line 190 records "no opinion" responses for their total as displayed in Column 16.

Lines 250 through 290 calculate the averages (arithmetic means) for, respectively, the total sample, males, females, age 30+ and age 29-, while line 300 records the sample total. (See Figure 2.)

Lines 310 through 350 calculate the standard deviations for, respectively, the total sample, males, females, age 30+ and age 29- (see any standard Statistics text for statement and explanation of the formula for the standard deviation). Results are displayed in Columns #11 through #15, respectively, as in Figure 2.

Lines 360 and 370 calculate the *standard error of the difference between the Means* for males vs females and age 30+ vs 29-, respectively, recording these values for printing in Columns 17 and 19 for each question/item (see Figure 2). (Formula is available in any standard Statistics text.)

```
-------------------------------------------------------------
TOTAL SAMPLE =  9
TOTAL MALES =  4                TOTAL FEMALES =  5
TOTAL AGE 30+ = 5               TOTAL 29- = 4
=============================================================
 1              21              17              12              26
 4.22           5.25            3.4             2.4             6.5
 2.44           2.68            1.85            1.5             1.12
 2              1.58            1.17            .87             4.7
 0

*************************************************************
 2              12              36              27              21
 5.33           3               7.2             5.4             5.25
 2.62           1.58            1.6             2.42            2.86
 2              1.07            3.94            1.79            .08
 0

*************************************************************
 3              30              35              37              28
 7.22           7.5             7               7.4             7
 1.47           1.5             1.41            1.36            1.58
 2              .98             .51             1               .4
 0

*************************************************************
 4              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0

*************************************************************
 5              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0

*************************************************************
 6              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0

*************************************************************
 7              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0              0               0               0               0
 0
```

Figure 3. Actual program output (for 3 sample questions from DATA statements in Program A). Note: The underlining of 3.94 in Question 2 and .51 and .4 in Question 3 is to draw attention to an *enormous statistical significance* in the difference between "male" and "female" responses to Question 2. This, contrasted with virtually no significant differences in Question 3 ("males" and "females" of all ages indicate a preference for lower taxes).

Lines 380 and 390 calculate the *significance of the difference between means* (where 2 = a 95% statistical confidence level, 3 = a 99% statistical confidence level, etc.). For example, in the hypothetical and illustrative data here, there is virtually *no significance* in the difference between male and female responses on "abolishing the Social Security System" (Q 1) but a *very* significant difference in the responses of respondents *over and under age 30* (Column 20 for Q 1 shows a "4.7" value, meaning 4.7 standard errors of difference or a *greater than 99% probability* that the difference is *real*

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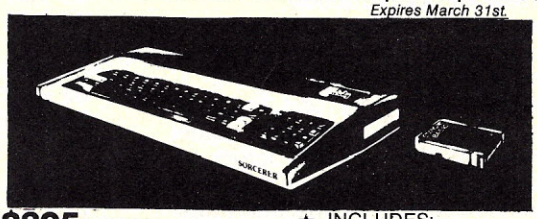

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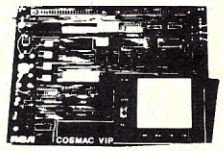

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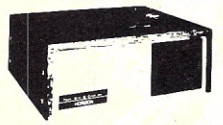

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rather than due to any kind of sampling chance). In Q 2, regarding the ERA amendment, Column 18 shows a similar huge significance of difference between *male* and *female* responses (3.94) while, in Q 3, no significant differences appear in either Columns 18 (males vs females) or 20 (age 30+ vs 29–), meaning that there is not much difference among the categories about the desire for tax reduction.

Lines 420 through 550 are the printing routine. Again, please note the comma ending Line 490.

In each DATA line, one for each survey respondent, the first datum indicates sex, the second datum indicates age, the third datum indicates numerical response to the first question, the fourth datum indicates response to the second question and the fifth datum indicates response to the third question. *Important Note*: In actual use, the user will want more than the three "questions" illustrated here; thus, Line 150 must be changed to establish the *exact* number of questions such as 150 FOR Q = 1 TO 10 (for a survey of ten questions) or 150 FOR Q = 1 TO 50 (for a survey of fifty questions).

The last DATA line must end with a -1 dummy data to move the program to an end.

A special note about the .0001 in lines 380 and 390: the .0001 assures a RUN and avoidance of an occasional "division by zero" error message without affecting the substantial results produced in Columns 18 and 20 for each row (question) number.

Varieties of Application

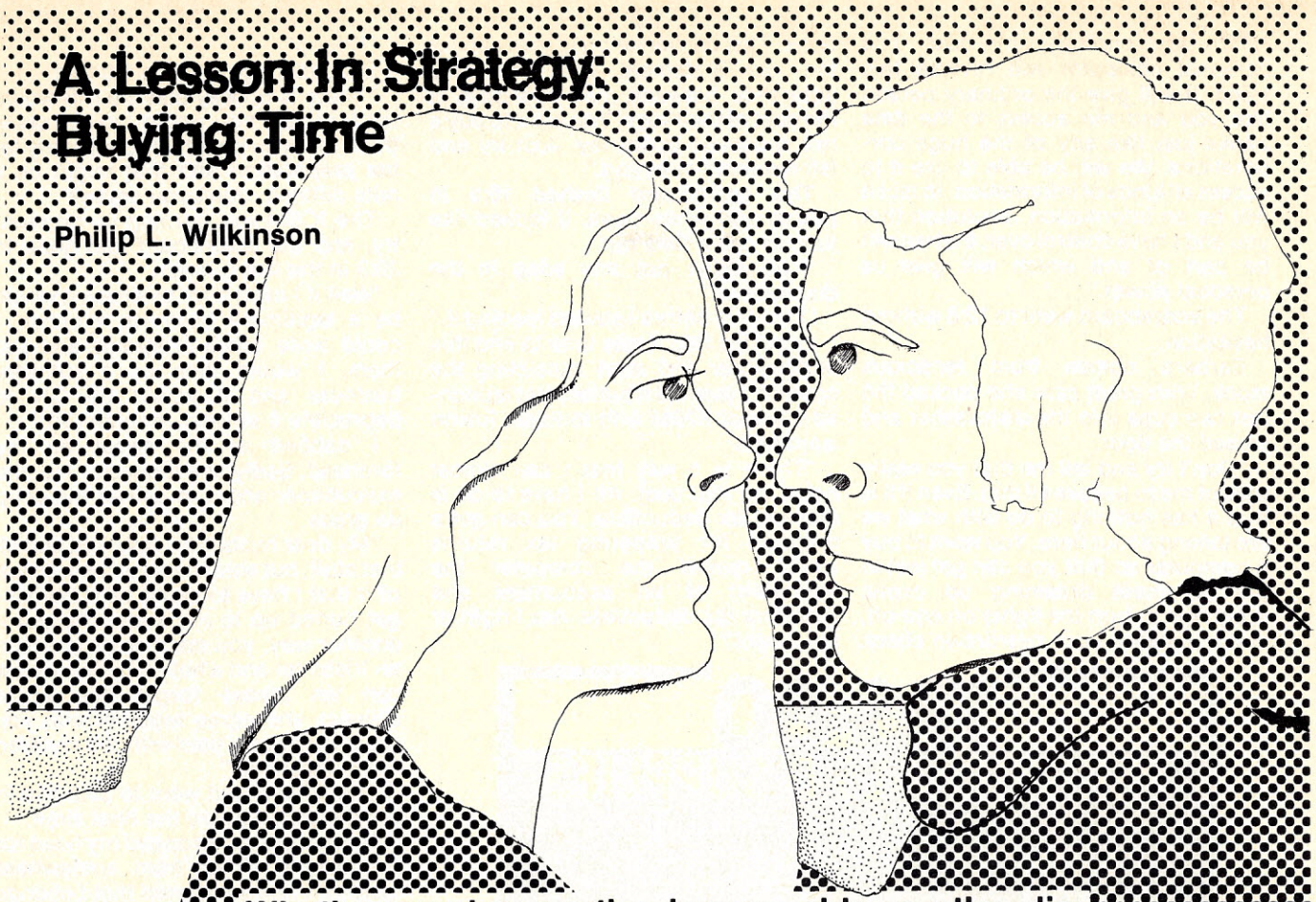
With minor changes in the basic program, a user can obtain professional-type statistical results for a large variety of combinations of sample categories, number and type of questions in a questionnaire, statistical calculations and video display. ■

```
3  REM ----------------------------------
4  REM    SOCIAL SCIENCE SURVEY PROGRAM
5  REM        BY DR. JAMES OWENS
7  REM
8  REM    CREATIVE COMPUTING MAGAZINE
9  REM ----------------------------------
10 DEF FNH(X)=INT(X*100+.5)/100
20 DIM S(50,21)
30 FOR R=1 TO 50
40 LET S(R,1)=R
50 FOR C=2 TO 21
60 LET S(R,C)=0
70 NEXT C
80 NEXT R
90 READ P
95 IF P=-1 THEN GOTO 240
100 IF P=2 THEN LET M=M+1
110 IF P=3 THEN LET F=F+1
120 READ R
130 IF R=4 THEN LET O=O+1
140 IF R=5 THEN LET U=U+1
150 FOR Q=1 TO 3
160 READ A
170 LET S(Q,P)=S(Q,P)+A
180 LET S(Q,P+15)=S(Q,P+15)+A^2
190 IF A=5 THEN LET S(Q,16)=S(Q,16)+1
200 LET S(Q,R)=S(Q,R)+A
210 LET S(Q,R+15)=S(Q,R+15)+A^2
220 NEXT Q
230 GOTO 90
240 FOR R=1 TO 50
250 LET S(R,6)=(S(R,2)+S(R,3))/(M+F)
260 LET S(R,7)=S(R,2)/M
270 LET S(R,8)=S(R,3)/F
280 LET S(R,9)=S(R,4)/O
290 LET S(R,10)=S(R,5)/U
300 LET T=M+F
310 LET S(R,11)=SQR((S(R,17)+S(R,18))/T)-S(R,6)^2)
320 LET S(R,12)=SQR((S(R,17)/M)-S(R,7)^2)
330 LET S(R,13)=SQR((S(R,18)/F)-S(R,8)^2)
340 LET S(R,14)=SQR((S(R,19)/O)-S(R,9)^2)
350 LET S(R,15)=SQR((S(R,20)/U)-S(R,10)^2)
360 LET S(R,17)=SQR((S(R,12)^2/M)+(S(R,13)^2/F))
370 LET S(R,19)=SQR((S(R,14)^2/O)+(S(R,15)^2/U))
380 LET S(R,18)=ABS((S(R,7)-S(R,8)))/(S(R,17)+1E-04)
390 LET S(R,20)=ABS((S(R,9)-S(R,10)))/(S(R,19)+1E-04)
400 NEXT R
420 PRINT "-----------------------------------------"
430 PRINT"TOTAL SAMPLE = ";T
440 PRINT"TOTAL MALES = ";M,"TOTAL FEMALES = ";F
450 PRINT"TOTAL AGE 30+ =";O,"TOTAL 29- =";U
460 PRINT"========================================="
470 FOR R=1 TO 50
480 FOR C=1 TO 21
490 PRINT FNH(S(R,C)),
500 NEXT C
510 PRINT
520 PRINT
530 PRINT
540 PRINT"*****************************************"
550 NEXT R
560 END
901 DATA 2,4,1,2,8
902 DATA 2,4,5,4,9
903 DATA 3,4,2,9,5
904 DATA 3,4,3,7,7
905 DATA 3,4,1,5,8
906 DATA 2,5,8,1,5
907 DATA 2,5,7,5,8
908 DATA 3,5,6,9,6
909 DATA 3,5,5,6,9,-1
```

Program A. Social Science Survey Program. (With the exception of the title, REM statements do not appear in the program in order to conserve memory. Documentation for the program statements is provided in the article. The program lines, excepting DATA, use 1.4K of memory.)

A Lesson In Strategy: Buying Time

Philip L. Wilkinson



Whether you're on the buyers side, or the dissuaders, you'll find the following contest interesting.

"What are you going to do tomorrow?" asked Barbara as she loaded the dishwasher.

"I thought I might drop by the computer store and look around." She glanced at me and poked a spaghetti coated fork into the cutlery basket.

"How much do you think we can afford to spend on that trip to Canada in August?" she asked, smiling innocently. I was puzzled at first by this apparent digression into the world of family finance, until I suddenly realized that it was a Trojan horse aimed at defeating the computer purchase I had not even mentioned yet. On the mental scoreboard that I reserved for these contests, ten points flashed to Barbara for three star triple distilled sneakiness.

Nonchalantly, I held up the newspaper and pretended boredom.

"It's not going to be too bad. I figure that with the concession fares that Canadian Airways offers it won't hurt us too much at all."

"Even with the two girls figured in?"

"Yes I figured the girls in. If you compare the cost of driving up there we are actually saving money. It's over two thousand miles, and with food, gas and hotel bills for three days we are saving money by flying."

Philip L. Wilkinson, 755 Pt. San Pedro Rd., San Rafael, CA 94901.

The scoreboard went to 10:3.

"Why don't you stay home and play with the girls in the morning?"

"Because I want to go to the store."

"You know we can't afford to buy a computer, so why be a masochist and tempt yourself with something that you are not going to get?"

The lights on the scoreboard flashed, but stayed at 10:3 in favor of Barbara. I had to get some of my plays in action, and fast.

"Well it's not exactly tempting myself. I think of it more as a learning exercise."

I smiled confidently. The scoreboard flickered reluctantly to 10:4 for a moment before settling back on 10:3.

"In fact, by 1980 every home in the country will probably have at least one microcomputer. To get in on the ground floor now is an investment in the future."

Looking like they might fade out altogether, the scoreboard lights finally settled on 10:4. Barbara smiled sweetly, then cut through my verbiage like a Samurai warrior.

"An investment in the future. That certainly sounds nice. I guess you mean that you are going to make money with it. Feed hungry mouths, keep us all warm when the winter winds blow and put clothes on our backs? What are you going to do, buy a sewing machine attachment and produce computer made clothes?"

Casually, I wiped away the moisture that had gathered on my upper lip.

"Well not exactly. I am not going to work at it full time. It would be stupid to give up my job now, wouldn't it?"

I paused for effect and watched her move four spaghetti stained plates like a sergeant marshalling recruits into the shower. The scoreboard had jumped to 12:4 after the last Samurai slice. This time it stared back at me with unblinking electronic eyes.

"What I meant was a little more subtle than that. We have to keep up with today's technology. Modern man has become alienated and depersonalized by the machines and the computers."

Buried in the jungle depths of his newspaper, the great white hunter waited for the prey to step inside his trap.

"If man is depersonalized by computers, why are you talking about buying one? That does not make sense to me. Won't that just add to our problems, particularly the monthly payments?"

The great white hunter leapt from cover as the trap clanged shut.

"On the contrary my dear. The personal computer will reverse this trend. It will give the ordinary person like you and me access to the data banks just like any of the huge corporations. We will be able to use it to access all kinds of information. In fact it will be an information revolution that you and I have control over, that we will be part of and which will give us personal power."

The scoreboard went to 12:8 without hesitation.

Barbara comes from tenacious stock. With great care she packed the last two cups into the dishwasher and closed the door.

"Don't try and tell me that you really expect me to believe all that. Even if it is true it has nothing to do with what we are talking about here. You want to buy a computer so that you can get lost in the basement dreaming up exotic programs to turn the lights on and off, and to balance your overdrawn check book. This conversation is really about the old statement that the only difference between men and boys is the cost of their toys. You want to buy a two thousand dollar toy. Just try and tell me that I'm wrong."

The scoreboard flashed 16:8 in purple and white neon. It looked like time to call a time out.

"You didn't put any soap in the dishwasher."

"I put it in before I started loading it."

I decided that it was time to end this tactical war and start escalating the conflict. I pushed a button that launched a verbal ICBM with multiple fusion warheads.

"There is a way that I can almost halve the real cost. All I have to do is make it tax deductible. You can get a program for preparing tax returns which makes the computer the equivalent of an accountant and therefore tax deductible. Am I right or am I right?"

"Wrong."

Second stage ignition faltered.

"There is no way that the IRS would fall for that. You would have to show them that you bought it specifically for tax preparation and that might be a mite difficult, don't you agree?"

The ICBM was burning up on reentry, and the scoreboard had gone to 20:8 in the last quarter.

'Well if I used it for business it would be a legitimate business expense. I could write some programs and sell them. I would then be a software business and it would be OK to depreciate it at least, wouldn't it?"

I dabbed at the sweat on my forehead. Sadly she looked at me, the executioner about to deliver the coup de grace.

"My dear husband. I love you and all that stuff, but sometimes you are so full of it that I have to stand back before I get buried up to my knees. To put it another way, you are a cross between an Irishman and a hot air balloon. Now can we please forget this whole silliness and agree together that you will spend some time with the children in the morning?"

The scoreboard went to 30:8 and in the distance I heard the final siren.

Disconsolate, I dropped my head for a moment. Then from somewhere inside a voice whispered that I change the game. With a flash of inspiration, Captain James Kirk of the Starship "Enterprise" initiated the computer sequence to fire a photon torpedo. On the viewscreens he watched it arc in towards the scoreboard, until at a thousand yards the proximity fuse armed the warhead. The scoreboard disappeared in a blinding white flash, and in the silence little pieces of charred wood fell like rain.

I lifted my head and looked at Barbara with what I hoped looked like defeat.

"I tell you what, I'll take the girls with me. They can play Wumpus while I look around."

Surreptitiously, I felt my pocket to make sure that the check book was there. It was going to be a great day tomorrow, at least until I came home. Whistling a tuneless tune, I pretended to read the newspaper. ■

"Honey, were you saving this for anything special?"

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The Inverse Peter Principle

A. Nonymous

AFTER READING *The Peter Principle* and its sequel *The Peter Prescription*, it has occurred to me that Dr. Peter, astute though he undoubtedly is, got the whole process backward when he stated that an employee starts off competent, then rises, through promotion, to a position where he is not competent to perform his job. I have found that more often than not, the very opposite happens: those employees who demonstrate competence in performing menial technical tasks tend to remain at the bottom performing those tasks, since it is in the company's interest to make sure those basic functions are performed with as little fuss and retraining of newcomers as possible.

Conversely, those who enter at the bottom and soon demonstrate an inability to perform their assigned routine tasks are promoted upward in hopes that they will make a greater contribution as supervisors, coordinators, administrators, and the like. In short, having failed as specialists, they become generalists. It would be satisfying to complete the reverse analogy with the Peter Principle by concluding that most such people go from a level of incompetence to one of competence, but I cannot in good conscience say that. What happens is that they move from a level where their incompetence is glaring to one where it is not so obvious. (It is more difficult to prove a generalist wrong than a detail man.) So we might formulate our "anti-Peter Principle" thus:

> "Incompetents rise to a level where their deficiencies are no longer obvious, while those who are truly competent at the bottom tend to stay there."

Let me illustrate this revolutionary thesis with a hypothetical example, supported by three actual case histories, of how this applies to the field of data processing.

Hypothetical dp example

Back in the good old days, when jobs in data processing were plentiful, the typical career path went something like this:

1. New college graduate enters dp field as a programmer-trainee. After six weeks of bits and bytes he is turned loose to write a program. At this point our hero learns his first great truth: programming is a hard way to make a living. It requires ingenuity, analytical ability, infinite patience and a high tolerance for frustration. His first project is over-budget, late, and won't run right more than once in a row. Our hero decides to change jobs.
2. Realizing his incompetence at programming, our hero decides to advertise himself as a systems analyst. (Our hero is no dummy; he is merely no good at programming.) After all, systems analysts have more prestige than programmers and are paid better. Also since no one really knows what systems analysts are supposed to know or do, or even what, exactly, systems analysis is, it is harder to spot an incompetent systems analyst than an incompetent programmer. Also it takes longer. Therefore an incompetent systems analyst can survive longer at higher pay with greater prestige than an incompetent programmer. Our hero needs only common sense and one or two disasters in programming to discover this.
   Eventually, though, after several years of "designing systems" a pattern begins to emerge. Our hero has a habit of designing systems no one can use, that are expensive to run (when they *are* run), and which need a full-time maintenance programmer to keep "up." Time for the next "promotion."
3. Two possibilities present themselves:
   (a) go technical and become a "consultant"
   (b) go administrative and become a "manager"
   In either case, all that is required is a jazzed-up resume stating the glories (in the most obscure jargon, acronyms and abbreviations) of past systems he "designed" (technical side) or the number of "project teams" he managed (managerial side).

From here on, a curious phenomenon takes place: our hero, no matter how inept, will be protected by the "system." Specifically, he will continue to rise, in spite of his incapability to do anything right, because those who hired/promoted him in the first place must vindicate their judgment by continuing the charade and heaping rewards on our hero. This is sometimes referred to as "promoting from within." Sometimes it is called "career pathing." Sometimes it is called throwing good money after bad.

In any case, once the manager/consultant level is reached, our hero is protected by the very strong self-perpetuating, self-preserving instincts of the upper-echelon hierarchy. It takes a major disaster of practically national proportions to reveal incompetence at this high level. Our hero started at the bottom as an incompetent programmer and simply kept rising until he came to rest at a level where the job requirements were so general that his incompetence all but disappeared from view. He did not become more competent but *appeared* to do so due to the changing nature of his job.

Case history number one

Jane Doe (name fictitious) was a competent programmer. She wrote programs which not only ran when they were told to, they could be understood, and (due to their modular design) could even be *modified* by other programmers. Jane was so unusual in her group that her supervisor realized his job would be in jeopardy if she stopped writing programs (for one reason or another). To keep Jane reasonably happy, instead of promoting her, he gave her annual salary increments until she was at the top of her "salary bracket." It was not in her company's interest to promote her because she was too valuable to be given a teaching assignment to train others in her skills. It was not even in her own interests to be promoted, since she would have to take a cut in salary to enter the next

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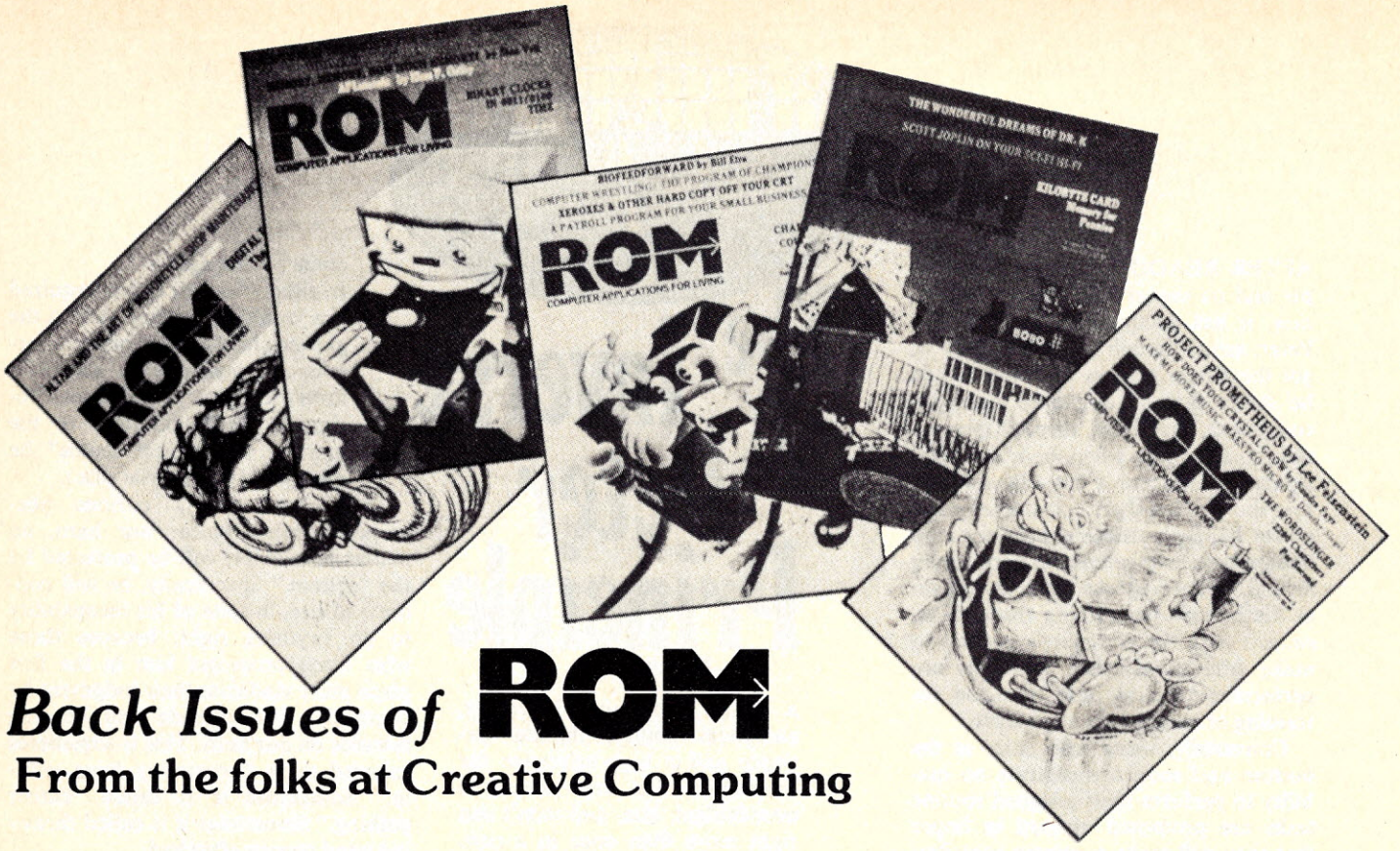

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salary bracket in the middle, where everyone else did. She could not quit, of course, for the same reason: she was grossly overpaid for the job-level she was at. So there Jane stayed until the last 370 was shoveled out the door in favor of the new IBM 390/225 TVM, a totally virtual machine. Jane had never been sprung from her programming tasks long enough to learn the ins and outs of programming for totally virtual machines. At this point, she was early-retired at the age of 43 at 10% of her annual salary averaged over the preceding five years.

Case history number two

John Doe (no relation to Jane) was a medium-competent programmer, but, having more moxie than Jane, threatened to go elsewhere for a twenty percent raise (this was 1968) if he was not promoted to project supervisor. In this position he functioned rather well; he was highly motivated, and just arrogant enough to press those under him to get his first project out on time *and under budget!* Being highly motivated, he was now ready for a quick second promotion to programming manager. But, as luck would have it, the clients were so pleased with the new system they funded a second proj-

ect, to add certain "enhancements" to the original system, but only on condition that John be project supervisor (again).

John did not like the prospect of sitting in the same old job for possibly another six months, but he had established a reputation as a "doer," and it would be silly to go elsewhere and start again from scratch. Also he might not be so lucky a second time. So John stayed on and built on his reputation of competence. He delivered the "enhancements" on time again, using the same competent programming team,

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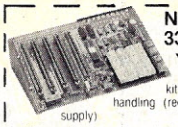

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naturally. After this "follow-on" project came another "follow-on" project to soup up the system still further. In the end, the client was so pleased with John's handling of the follow-on projects that he requested that John become permanent client coordinator. There John sat, at the second level from the bottom, until the client switched to a new time-sharing service and the system had to be rewritten to take advantage of the new capabilities. Of course John had been so busy holding the client's hand that he had never had time to be trained in time-sharing. John was early-retired at the age of 45 at 25% of his annual salary averaged over the preceding five years.

Case history number three

Bob Roe was a semi-competent programmer who managed to stay out of trouble for five years and was finally promoted to systems analyst. As a systems analyst he managed to avoid disaster by judiciously hedging his bets and staying away from large, expensive, visible projects. But he could not be said to be noticeably incompetent, and managed to give the impression of knowing how to do things. (In fact, he spent most of his time giving advice to others, having learned that advising is safer and easier than doing.) Bob's trouble was that his immediate boss had achieved final placement (see *The Peter Principle),* having achieved a level where his incompetence was no longer apparent. Bob's boss relied heavily on him to answer questions of the "what does your department do?" variety, since he himself didn't have too clear an idea. (He could explain it *in concept* but people just went away shaking their heads and asked Bob the same questions.)

So there Bob sat, one level below his boss, whose function no one was sure of since he hadn't done anything in five years. He couldn't be fired either, since he spoke so impressively that the listener went away convinced that whatever it was he did do, it must be very complicated and beyond the understanding of the average intellect. Bob was finally early-retired at the age of 47 at 35% of. . . .

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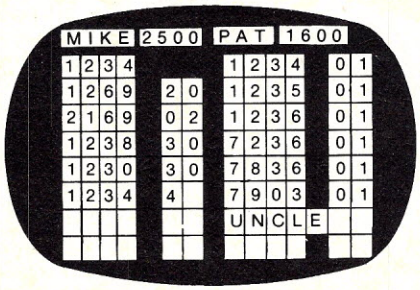

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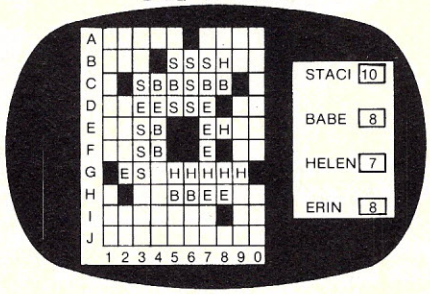

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I hope these examples have convinced the reader of the wrongness of the Peter Principle. People do not rise to their level of incompetence. The competent stay put; they are too valuable where they are. Eventually they become overpaid for their rank and are thus locked in to low-level jobs. The generally incompetent (the vast majority of the business and technical population) move upward through promotion or through intercompany diagonal transfers to the point where their incompetence becomes invisible to all but the most discerning and cynical observers from below.

Dr. Peter was off the track again when he assumed that the rational em-

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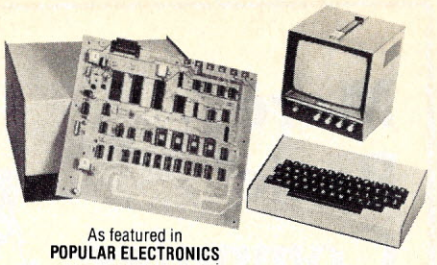

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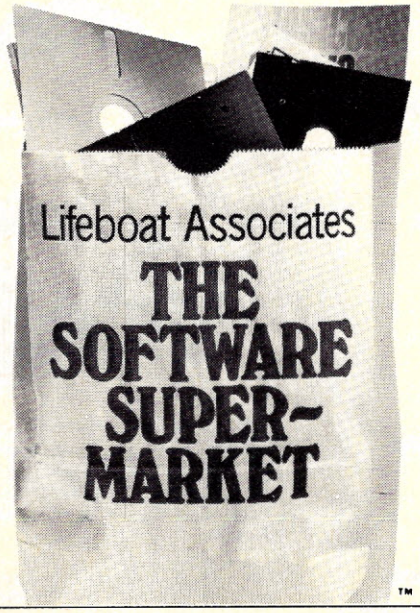

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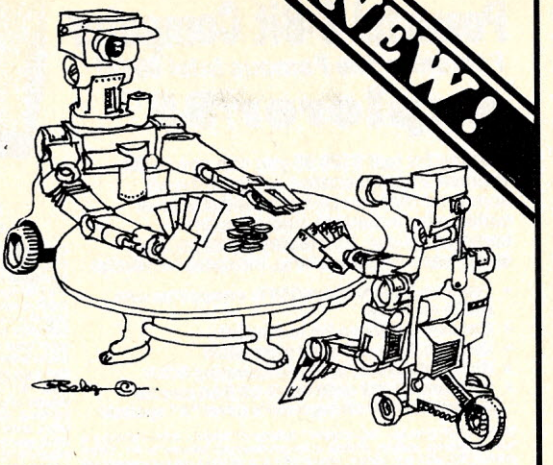

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ployee would wish to *avoid* final placement. On the contrary, that is what we all strive for, rational or not. The method of achieving final placement is, amazingly enough, exactly the prescription advocated by Dr. Peter as a means of avoiding final placement: mask your competence behind the guise of mild incompetence! The reader should not be surprised at this curious negative reasoning, since we now realize Dr. Peter was 180° turned around in the first place. Remember, those who flaunt their competence will remain exactly where they are . . . at the bottom of the hierarchy, since they are too valuable to be promoted. To move upward, exhibit at least the normal amount of incompetence, and, since you are not making a contribution where you are but have done nothing to warrant firing, the only choice is to promote you. This play can be repeated as often as you like, achieving constant upward movement. In fact, your security in doing this is directly proportional to your length of service, ("we can't just let him go after twenty years with the company"), and your rank ("he must be good, otherwise how did he get this far?").*

I apologize to Dr. Peter for controverting his theory, but my humanitarian instincts lead me to publish my own theory before too many well-meaning people are hoist by their own petards. I have seen too many obviously competent people, striving to achieve final placement, frozen in their tracks due to their own competence to keep the real truth a secret any longer. Dr. Peter was wrong on two counts: he saw both the criteria for advancement and human ambition bass-ackwards. □

Mr. Nonymous, who is so for undisclosed reasons, does work of an unknown nature, does not live there, and has left no forwarding address. Where is he? Only the Shadow knows.

*For a specific example of this type of reasoning, see "The Emperor's New Clothes."

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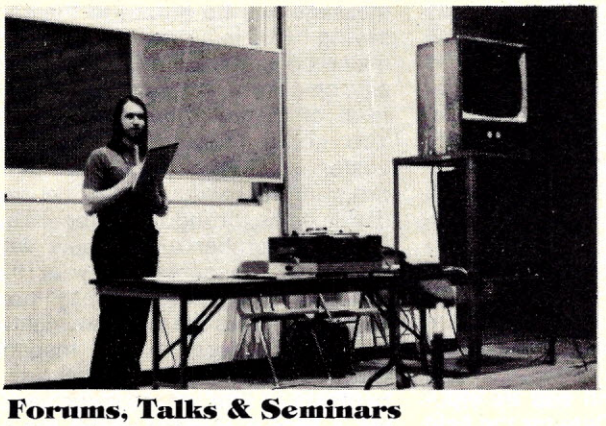

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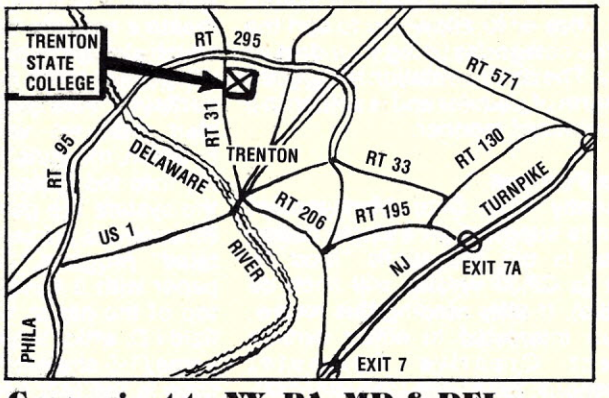

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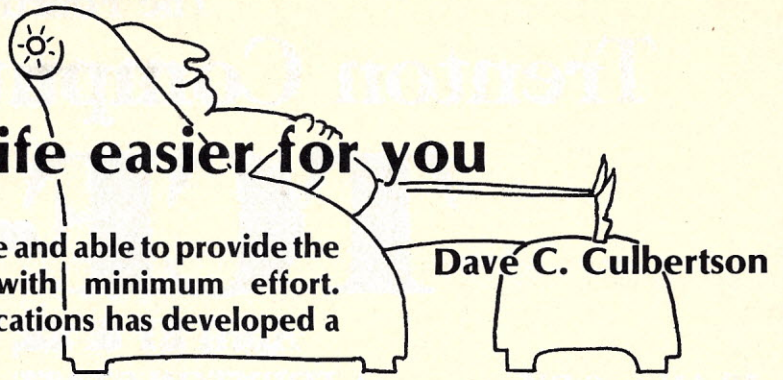
A Data Base System With A Purpose



Making life easier for you

Data base systems should be easy to use and able to provide the user with valuable information...with minimum effort. Apparently Creative Computer Applications has developed a system which does just that.

Dave C. Culbertson

Relatively few people can accurately define a data management system. This type of program could be very important to an individual as well as any business. We all have to list or catalogue items but the problem is that the subject of these lists will vary. Many programmers make a valiant effort in trying to write individual programs to cover most of the routine needs they have. Unfortunately, there seems to be no end to the number of different types of items you wish to keep track of.

Creative Computer Applications has supplied the solution to this big headache. Their Data Management System is a dream come true. The program is written from the programmers point of view. It allows you to customize the number of data inputs as well as the names of the entry prompts, without rewriting program lines. These data prompts will also be used later in the program to output report titles or to allow you to sort the data into categories using your data as the key. The documentation is supplied in the form of a binder and is written in a well organized manner.

System Features

Presently this Data Management System is supplied on a single floppy diskette in the Micropolis "Mod II" format (a CP/M version will soon be available). If after reading this review, you are interested in either version contact Creative Computer Applications, 2218 Glen Canyon Road, Altadena, CA 91001.

Now, to the specifics of this system. The program is supplied as a number of individual program segments. However the only program which the user must load and RUN is the first one, FMAINT. This is a menu program which automatically executes any of the required segments as they are needed. There are six choices; Termination of Processing, File Maintenance, Report Generation, File Compacting, File Defination and Sorting. With the combination of all of these functions put into one neat package and by comparing this to the same capabilities available in the CP/M format, there is a substantial cost savings in this system. You may use the program with either Micropolis' Basic Version 3.0 or 4.0. Due to the use of the chain function, I found that I could not list after running the Report Generator. It turned out to be due to a small bug in The Micropolis Basic. I had not sent in my Software Registration card and so Micropolis had not sent me the software update. A good lesson for all of us!

A Practical Application

In order to use this program and provide a better explanation of its functions, let us imagine that you have a small retail appliance store and wish to catalogue an up-to-date status on your customers as they bring in repairs. Your first task will be to use function 5 to Define the File. You may create a new file name, delete a name which already exists, list the file names which the system is aware of, or list the particular information for that file. To start with we will call the Create function, this puts the name of our new file into the system. We now must tell the system the particulars of this file. Since this is primarily a "Report Orientated" program, think of a piece of paper with a series of columns at the top of the paper, you must suggest a field I.D. which is an abbreviation of the name (1-5 characters). In our example, Date is the first column and we input DA for the I.D. code, Date for the field name, 7 as the tab position for the start of the field and 8 as the length of our field. This will allow the date to occupy positions 7 to 15 on our paper headings. We continue in a like manner for each heading we need. The system will then output to the terminal or your line printer a neat listing of all of this information. The system permits up to 24 column assignments. You are now ready to begin data entry. The menu will come back on the screen and allow you to select the file maintenance section. This section actually puts the name of the file on the disk and then allows you to add data, delete data, update any one section of a file, inspect a record, or scan the file for specific data. If you select the add function, a new record will be written at the end of the file. The program will begin to request each of the prompts you input in the previous step. If any prompt does not apply, you need only depress the return key. No data will be input for that prompt and the next one will appear on the screen. If you wish to change only one field you may use the update function. This works in a different manner. It requests the I.D. code and the data. This is sligthly inconvenient if you cannot remember the I.D. code but then you were the person who input this code in the first section. The delete function does not actually wipe out the entire record, it only flags this record for deletion. If you call this record, a message will be output to the screen saying "This is a deleted record." You may recover this condition by updating any one field. The scan function is a form of instant information retrieval. You could request the name of a customer, as in our example, and the program will search for the occurrence of this name through each record in the file. The number or numbers will be output to the screen. If your file is extensive this process may take a minute or so, as the program must look at every record. The inspection process allows you to call for the contents of that record, such as viewing a record number which the scan section has output.

After you have finished the input or posting of your data for that day, you have several choices for manipulation of the data. You may wish to print a report minus the deleted records. You may print a report with all the records, even the ones flagged for deletion. You may wish to sort the data in some manner or you may compact the entire file. We shall elect to compact our file. This process removes the deleted records and tightens up our file. Example: Suppose our file has 10

Dave C. Culbertson, 238 Exchange St., Chicopee, MA 01013.

records and #8 has been flagged for deletion. The file will be the same for the first 7 records, #8 will be gone, #9 becomes #8 and #10 becomes #9. We have several choices in this section, we can compact the file in place, with or without a back-up file, or create a new file under a different name. This process can take several minutes to perform if the file is large.

Now you may wish to sort the file into useable data. The counter personnel at your store may wish to have the list of customer names in alphabetical order. No problem for this system. You can sort on any field in ascending or descending order. The program can perform a full alphanumeric merging sort on any field or fields which you select. This means that if the boss walks in and says that he would like a report on the repairs which are ready and he would like a report on the item brands, with the most expensive repairs for each listed first, you have the capability to perform this function. All you have to do is to select the field for brand in ascending order and the field for total cost in descending order. Then print out your boss's request. This is one of the fastest, most versatile sorting routines I have ever seen, written in a Basic language.

We have now progressed to the object of all of our data posting, compacting and sorting; the printing out of our report. This is where many programs fail badly to provide the needed capabilities. This programming system is the exception to this rule. You input your title, width of your printer, depth of your paper, force (which designates whether or not to print out deleted records) and type (report form or printing of mailing labels). These are designated as the run options. You then have a choice as to which columns you want printed and in what order they will appear on your report. There is also an option to shorten or truncate the length of the individual fields. The report printed will be paginated with the title input for each page and a header line which contains the column heading. A useful option is the subtotal and total section. This allows a subtotal to appear for each company grouping or on any field you designate. You also have the option to specify the number of decimal places (up to 5 places). If this option is used, the subtotals will be printed on the following line in the report with a lined border the width of the page. The grand total will appear at the end of the report in a like manner.

The mailing labels section of this report generator performs in a similar manner, permitting the same versatility of printing as we found in the report form printout. The only critique I have for this section would be the inability to use multiwidth labels.

The Documentation

The documentation supplied with this system comes in two forms. First, you are supplied with a binder which contains complete information on every phase of the system. In using the system the programmer will note that each message output to the terminal will have a number assigned to the beginning of the line. In the book is a listing by number of every message, the reason for the message, your action required and the program results. This makes use of the programming system very easy. Also included is a sample execution log at the end of the binder. The system is also supplied with an inventory program. The format is written in a step-by-step self-teaching mode. This permits you to start using the system immediately although I would suggest you read the documentation to be able to make use of the variety of functions available.

Finally, a page in the documentation is provided to permit users to share suggestions for improving this Data Management System. If you acquire a copy of the system, I urge you to share those suggestions. This is one of the best Data Management Systems I have seen to date. With input from programmers across the country, it could become the best data management system ever written. ■

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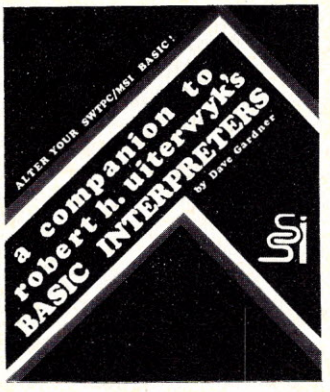

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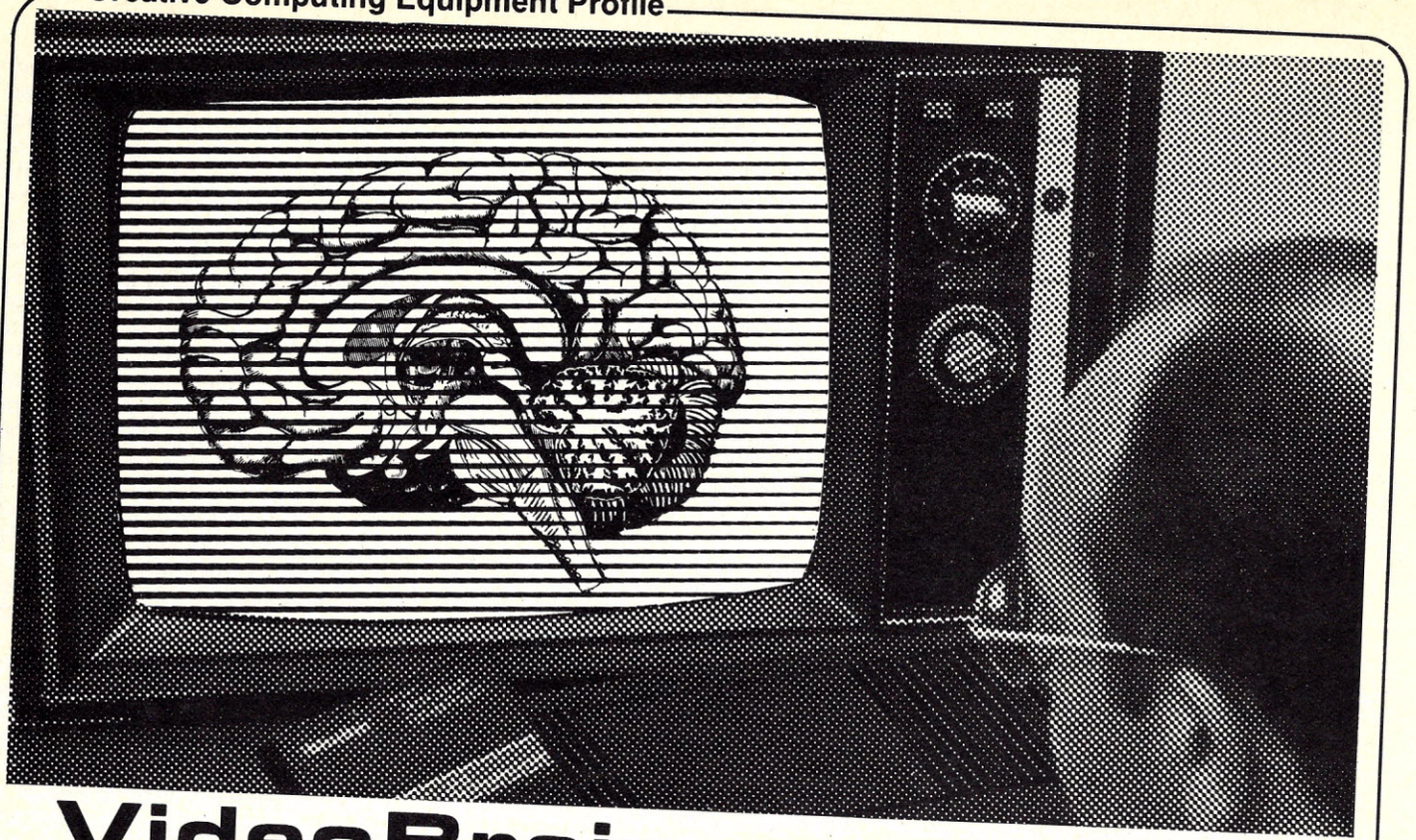


VideoBrain

David H. Ahl

Our VideoBrain arrived in a large carton containing the computer itself, two joysticks, a power supply, four program cartridges, and an instruction manual. We immediately plugged it in and hooked it up to a color TV set following the instructions on the handy "abbreviated instruction card." Most purchasers of computers or, for that matter any electronic device, are anxious to get it up and running as soon as possible. Frequently they do not stop and read the full instruction book before plugging the machine in, and as a result burn something out. Having an abbreviated set of instructions either on a card or in the beginning of the instruction book is very handy for overcoming people's natural impatience and also insuring that the unit is hooked up correctly.

One immediate problem we noticed was that we were not getting a particularly good picture on the color TV set. According to the instructions, "it is possible during the first few minutes after the VideoBrain has been turned on, and is still warming up, you will notice that the picture on your TV set jiggles somewhat. This is perfectly normal and will cease as soon as the machine has reached its operating temperature (2-5 minutes)." We waited the five minutes and our picture continued to jiggle and be unclear. Experimenting with other things revealed that the cable from the VideoBrain to the antenna terminal was responsible for the interference, and moving this cable around and uncoiling it (it is twelve feet long) cured the problem.

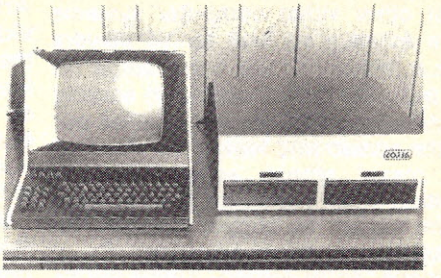
The power supply on VideoBrain appears to be a much heavier duty unit (and larger) than those found with other Video Games. We also liked the design of the joysticks, which are true joysticks (they move in all directions) with a large push-button in the upper left of the unit. Also the joysticks are on coiled cables (similar to a telephone cord) which makes for a somewhat neater setup (you don't have quite so many cables getting jumbled up with each other).

The first game we tried was **Gladiator (EN01).** This game cartridge has an incredible 384 variations ranging from Ancient Gladiator with one player to Future Gladiator with two players. Features include the ability of either your arrow, football, or Zap Gun to bounce around, to be guided, to speed up, as well as hazards such as lions and space mines. There are variations which allow each player or the player and the computer to be at different skill levels. Play ends when one or the other player reaches the total of nine points. With skilled players playing one of the fast "fast" variations, nine points are reached amazingly quickly. However, for the average player the playing time is about right.

Pinball (EN02) has 32 variations for one to four players. In this game there is a bouncing bumper which moves back and forth across the screen and hits your ball up to the point-scoring numbers in the top part of the screen. Game features include: fastball which increased the ball speed to a rather challenging pace, lucky spinner which is in the top bumper row and freezes the ball for a second making a brrrring noise and then mysteriously shoots the ball off in a new direction. A third option is Crazy Bounce, which adds an element of unpredictability to the game with a ball that goes bonkers and flies off in any direction it chooses. The player controls two flippers at the bottom of the screen with the two buttons on the joysticks. The game is fast-paced and exciting. However, the resolution of the playing field and the ball is considerably less than it is on the Atari Video Computer System or the Apple II. We understand that resolution is a function in the amount of memory in the plug-in ROM cartridge and not an inherent limitation in the VideoBrain itself. Indeed the Gladiator cartridge provides much higher resolution of the picture than the pinball cartridge or any of the text cartridges. One feature of pinball that drew mixed reviews is that the playing field colors change after each bounce of the ball. The colors used are rather vivid and many people found it disconcerting to have the background go from a vivid blue to purple to red to yellow to black on each bounce. Younger players seemed to adjust to these psychedelic color changes more easily than older players.

The **Tennis (EN03)** cartridge had some particularly cute features.

TAKE A CLOSER LOOK!



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The players instead of being the typical flat paddle found on most other video computer systems were actually stylized tennis players with a racket in their hand which hit the ball. The ball is placed in serving position by a ball boy who rushes out on the screen and leaves it in front of the player whose serve it is. In addition, a cute little row of five heads at the top of the screen looks in the direction of the ball (your Basic audience, so to speak). There are 64 variations for two or four players with fast balls; "bounce back" in which your first hit of the ball bounces off the net, and the second hit puts it over the net; and curve ball which allows you to put "English" on it. You also have an option of rushing the net from the normal back court position. Resolution, incidentally, on the tennis cartridge was outstanding.

Checkers (EN04) was written by Dr. Arthur Samuel, one of the real pioneers in artificial intelligence and in computer checkers. Back in 1949 while at IBM he wrote the first computer checker program to run on an IBM computer as a means of investigating new techniques of artificial intelligence. In the VideoBrain game, you have a choice of four opponents: Abe, Betty, Charlie, and Dorothy. These players correspond to four levels of skill. Unlike many of the other computer checker games, this one plays extremely well at all levels and you really need to employ thought and strategy to beat it. On the lowest skill level (Abe), VideoBrain makes its move fairly quickly and then repeats it in an "instant replay" so you can see what it did. At this skill level the computer is looking ahead roughly three moves on each turn. At skill level D the computer takes considerably longer to make its move and is looking ahead five to six moves on each turn. Moves are made by guiding the cursor with your joystick to the piece that you wish moved and pressing the button on the joystick. You then move the cursor to the position where you want it moved to and again press the button. Illegal moves are not permitted and jumps, when available, must be taken. VideoBrain beat us fairly easily at level B (we didn't dare even try level C or D).

Blackjack (EN05) is, well, blackjack. We eventually figured out how to play it, no thanks to the instruction book which has a correction in it. Unfortunately the corrected page five was glued on top of page seven in the instruction booklet, and page seven had some particularly crucial instructions. Consequently, it took some figuring how to play the program. Hopefully in later reprints of this booklet this will be corrected.

Vice Versa (EN06) is an interesting strategy game, also designed by Dr. Arthur Samuel, (who programmed VideoBrain checkers). It's based on the game of "reversi" and comes from the same family as the oriental games of "GO" and "GO MOKU." We won't attempt to explain the game here. Suffice to say it is thoroughly entertaining once you get the hang of it.

All of the preceding programs were from the entertainment series. The next programs are from the education series. As a group we found these considerably less satisfying than the entertainment programs.

Music Teacher-1 (ED01) allows you to play simple tunes on your VideoBrain and also has several tunes in memory which it asks you to learn. It comes with a music keyboard card which you can place near the regular keyboard (figure 1), however, we never really got used to this even after much time playing it. Music Teacher allows you to play a song on the computer keyboard and then have it played back. Unfortunately it plays the song back in exactly the same tempo in which you play it initially. For a child picking out a tune, this is somewhat less than satisfactory. Ideally you would like to allow the child to pick out the tune and then play it back at a different tempo than it was originally put in. However, within these limitations, the program is interesting and fun.

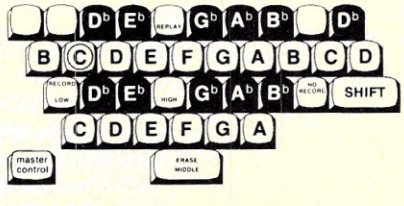

Figure 1. VideoBrain keys and their "musical note values."

Math Tutor-1 (ED02), as it's name implies, provides drill and practice in mathematics problems (addition, subtraction, multiplication and division). It has three levels of skill and can provide mixed problems or all problems of the same type. It gives positive reinforcement when the right answer is put in and encourages the learner to go on when the wrong answer is given. If a problem is missed twice in a row the correct answer is shown. One minor glitch in the program occurs when a multiplication problem has a zero in the second number to be multiplied. Rather than allowing the zero to be carried along, VideoBrain requires a line of zeros to put in the answer (see fig. 2).

On multiplication problems, VideoBrain requires input in this form:

```
  359
  604
 1436
 0000
2154
------
216836
```

rather than the more natural:

```
  359
  604
------
 1436
21540
------
216836
```

Figure 2

Also, when a multiplication problem is missed and VideoBrain shows the correct answer the intermediate steps are not shown. Only the two numbers to be multiplied and the answer. Unfortunately this does not allow a child to pinpoint his error (fig. 3).

If a multiplication problem is missed, VideoBrain shows this:

```
  468
x 337
------
157716
```

not this:

```
  468
  337
------
 3276
 1404
 1404
------
157716
```

Figure 3

Also with division problems the intermediate steps are not shown when VideoBrain shows you the correct answer after you miss a problem twice. This highlights one disadvantage with this sort of cartridge program on a ROM memory chip, that is one cannot go in and change the program if there is an error or if you wish to custom design it to your own requirements. In this sense, the VideoBrain is more like an Atari or Magnovox Video Game System than it is a computer.

Word Wise (ED03) is a scrabble-type of game which gives you ten letters and requires you to form three- to eight-letter words out of the jumble of letters. Up to four players can compete in this game. There's a time limit of 99 seconds for each player to form as

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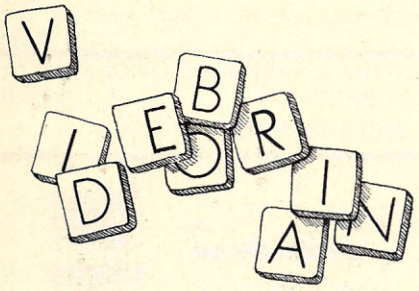
many words as he can. Following that, all of the other players are permitted to challenge any of the words that the first player has formed. After the challenge round the words remaining are counted with different point values being given to 3,4,5, etc. letter words. The game ends when one player amasses a total of 999 points. Scrabble and boggle aficionados will love this game.

Word Wise-2 (ED04) is a touch-typing teaching program. There are four parts to this program. In Program 1, "Key Learn," you simply have to duplicate the letter keys shown on the screen. After one minute, the program gives you a score in words per minute. Program 2, "Skill trainer" also presents random letter sequences as the letters appear diagonally on the typewriter keyboard. Program 3 "Speed quiz" asks you to type the well known typing exercise "the quick brown fox jumped over the lazy dogs." Your objective in this program is to duplicate this phrase as quickly and as often as you can. Again, your typing speed is shown in words per minute at the end of the exercise. The fourth program on this cartridge "Cyper" is a game for two or more players. Taking turns, one player (or team) at a time feeds a message into the computer. The computer takes the message and scrambles the letters of every word. The opposite player (or team) must than decipher the real message and type it correctly on the terminal. Well known phrases of short words are relatively easy to decipher however, we found that longer names of movies or books were almost impossible without substantial clues.



VideoArtist (ED05) is one of the most fascinating cartridges with which we've ever played. It allows up to four players using their joysticks to draw designs on the screen. All types of options are available to individual players as well as to all four. For example, there is an option with the cursor to wrap around from one side of the screen to the other. Another option changes the background color, the line colors, or the colors within sixteen areas on the screen. There is an option which provides reverses of line colors and background colors, another option which provides for a mirror effect, and still another which provides for a moving "fountain" effect. We found people of all ages fascinated by this particular cartridge. Sometimes having complete freedom to "do your own thing" is more important than the best planned pre-programmed game or exercise.

Lemonade Stand (ED06) is a simulation model of a lemonade stand. Your objective in this simulation is to make your stand profitable enough to parlay your $2.00 in starting assets to $10.00 or more. Lemonade Stand is actually a simplified version of the Huntington II program "Market." There are four levels of play from beginner to expert. At Level 1 it is relatively easy to make money if you just keep your price and volume relationships in line. Level 2 introduces the concept of advertising. Level 3 introduces competition of other stands and requires that the player adapt to what's going on at his competitors. There are random factors which affect the sales of lemonade such as heat wave which is good, rain coming which is bad, and a thunder storm which is very bad. The circus coming (accompanied by an elephant walking across the screen) is very good.

We tried one program in the money management series, **Financier (VB-81).** This cartridge of programs with its accompanying 48-page instruction booklet was relatively difficult to get the hang of. The booklet spent many pages on a description of the operation of the program solving formulas, computer variables, and using functions. In a sense what was done was to write a pseudo language for solving financial problems, which hopefully would be comprehensible to most users. Some of the calculations were certainly useful, such as, computing the future value of money in a savings account and computing depreciation by different methods. To the serious purchaser who is willing to spend two or three hours learning how to affectively use this program, it should certainly be valuable. In this program the formulas and calculations are shown at the bottom half of the screen while the top half displays a bar graph (see figure 4). For the most part, we found the bar graph somewhat annoying and not particularly useful. However, for the average uninitiated consumer the bar graph may well be a nice touch. Unfortunately, having only half of the screen available limits the display to four lines of sixteen characters per line. If you're used to a computer that displays twenty-four lines of eighty characters or even sixteen lines of sixty-four characters, you'll find four lines with sixteen characters extremely limited. However, for the intended consumer audience maybe this is satisfactory.

Figure 4. VideoBrain displays a bar graph in the upper part of the screen and 4 lines of type below.

The computer itself, without any cartridge in it has the ability to store a seven line (16 characters per line) message and recall it at a later time. It also has a built in clock timer that you can set at the beginning of a session and recall any time you wish to see what the day and the time of day is. None of the cartridges at this point take advantage of the clock timer, so it's not clear that it offers much more value than a wrist watch. However, we assume that future cartridges and/or programs that you write yourself will be able to use this real time feature.

We haven't had a chance to try the APLS language for the VideoBrain computer. However, when we get our copy and have put it through its paces, you can be sure you will see a report of it on these pages. ■

The Game Of Go — The Ultimate Programming Challenge?

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Go is superior to Chess in almost every respect: Conceptually more elegant, strategically more profound, and tactically more complex.

Like many of you, I became fascinated with and deeply engrossed in Chess, at least partially because of its reputation as the strategic board game par excellence. Therefore, you will probably share my feelings of disbelief upon learning that Go is superior to Chess in almost every respect: Conceptually more elegant, strategically more profound, and tactically more complex. Incredible, yet true. To convince you, let me tell you a little about Go and why it constitutes such a programming challenge. Perhaps most important, the scope of Go is vast. Because of its astronomical number of possible move permutations on a 19 x 19 line board, cataloging full board openings (called Fuseki) in Go is infeasible, but there are published "dictionaries"[1] which analyze and codify thousands of individual corner sequences (called Joseki), each of which is fully comparable to a complete Chess Opening. Which Joseki are playable in a given corner of a particular game of Go is dependent upon the stones already played elsewhere on the board. For this reason, rote memory of Joseki is much less useful than equivalent "book" knowledge of the Chess Openings, and may even be disastrously counter-productive because each Fuseki allows for up to four Joseki sequences together with all of the interactions which they generate, spreading over the entire board. If a game of Chess represents a battle, Go represents the whole war! One of its more attractive aspects is the fact that Go has a remarkable handicap system which is fully compatible with normal play. This unique system permits players on vastly different skill levels to have enjoyable games together in which the better player must utilize all of his superior skills if he is to prevail. At this point, you might well ask "If Go is so good, why haven't I heard of it before?" To answer that question, it will be useful to take a very brief look at the history of Go.

Milton N. Bradley 22 Goldfield St. Melville, NY 11746

The History of Go

Go was invented somewhere in the China, Tibet, Nepal area around 2000 B.C. In its earliest form, it was probably somewhat simpler than at present, and our best guess is that a game then ended with the first capture. By the time of Confucius, Go was already quite like the modern game and well established in China as the respected and exclusive province of the Mandarins. About 1200 years ago, it reached Japan, where it was so highly regarded that only members of the Royal Court were permitted to play. Others could play, but only on pain of death! By about 1000 A.D., the tactics of Go were essentially fully developed, but sophisticated strategy on a modern level did not really exist before 1612 when the Shogun Tokugawa's government established four Go schools. The teachers in these schools received annual living allowances, and were thus free to devote full time to Go research and competition. The modern game and Go academies in Japan are the direct descendants and beneficiaries of this effort, and these last 366 years of development have created the magnificently sophisticated game that we now enjoy. In the early 1930's, Go underwent a revolution closely analogous to the Hypermodern revolution in chess of the 1920's which was led by Nimzovitch and Reti. The Shin (new) Fuseki in Go was developed by Kitani Minoru[2] and Go Sei Gen, and introduced a much more aggressive and large-scale style of opening play to what had been primarily a cautious and territorially oriented game.

Until about 100 years ago, Go was apparently completely unknown outside the Orient, but even after its introduction to Europe in the 1870's and the U.S. in the 1890's it spread very slowly. The main problem was the almost total lack of literature in other than Japanese and Chinese. Another complicating factor was that until very recently Go was played almost exclusively by the upper class intellectuals, so that most of the working class Chinese and Japanese who emigrated to the West did not bring a knowledge of Go with them. The first Western Go primer appeared in Germany[3] in the 1880's and the first English language primer, *The Game of Go*[4] by Arthur Smith, was published in the USA in 1908, but these were hardly best sellers. In the 1930's, the American Chess Master Edward Lasker published his *Go and Go-Moku*[5] and an Appendix on Go in his *Modern Chess Strategy*[6] and until after WW II those four books remained the total Western literature on the world's finest strategic board game! Then, the Japanese Go Association (Nihon Kiin) began publishing some English language primers[7,8,9] and a monthly Go magazine called *Go Review*. At this time, the American Go Association awoke from a long period of near dormancy by publishing the *American Go Journal*[10], and the dissemination of Go in the USA really began in earnest. The final and most important development in the worldwide growth

Go and Microcomputers

Microcomputer enthusiasts may be dismayed when they learn that Go has, to date, only been programmed on an Amdahl 470 with 250K of memory and a DEC-System 10, neither of which you'd call a computer featherweight. Nevertheless, there are several reasons why we're publishing a detailed overview of Go and its programming possibilities in Creative Computing.

1) Go is a fascinating game in itself.

2) Remember that only a few years ago, Chess-playing programs were found only on big monsters like Amdahl 470s. No one would even dare suggest that Chess could be programmed on a small 8-bit machine. Yet today there are several reasonable chess-playing programs for microcomputers.

3) Likewise, personal computing hardware is increasing dramatically in power. 16-bit microcomputers may soon be with us in force, and Motorola is developing a 32-bit microprocessor—that's the same word size as an Amdahl. Also, newer, more powerful programming languages may simplify the programming process itself.

4) As the article brings out, Go can be scaled down without sacrificing the integrity of the game.

On the other hand, creating a smart Go-playing program is not a task to be lightly undertaken. Since the rules for playing Go are simpler than those of Chess, one could concentrate more on the decision-making aspects of play. Microchess, one of the most popular chess programs, attempts to find its best possible move using weighted factors such as mobility, maximum capturable piece, total attack, actual capture, and also assigns high values to moves forward and toward the center of the board, all calculated to a certain depth. On the basis of these factors alone, Microchess could not perceive a chance to attack a weak area of the board if it would not yield an immediate advantage of some kind. Yet Go would seem to require even more emphasis on strategy and tactics instead of a momentary positional advantage.

—Steve North

of Go did not take place until the late 1960's, with the formation by an American Go enthusiast of the Ishi Press, the first English language publisher of a complete spectrum of Go books. Now, at last, there was available in English an integrated series of tutorial Go texts covering elementary notions[11], strategy[12,-13], tactics [14], openings [15], endgame [16], master game analysis [17], etc. on a level comparable to the existing Chess literature. The result, as may have been expected, has been an explosion of Go interest and a vast improvement in the number of strong players. The fact that you may not have heard of Go before now is thus quite reasonable, since it has really only been a single decade from time zero.

There is a good reason why Go is called "A great game that no one plays well."

I will assume that if you've followed me thus far, you are now "chafing at the bit" to find out how this paragon of games is played, and to evaluate for yourself the magnitude of the problem of programming a computer to play it. The only caveat I make before presenting the rudiments of Go is that you keep in mind that we can only cover a small portion of the tip of a very large iceberg. In the limited space available, we can discuss the basics of the rules of play, and only the most fragmentary and elementary notions of strategy and tactics. This short introduction coupled with Go's structural elegance may fool you into thinking that it is much simpler than it really is, so beware! There is a good reason why Go is called "A great game that no one plays well." Although any intelligent person can readily learn the rudiments of Go in a few minutes, no one has truly mastered the game even after a lifetime of study. Therefore, Go remains endlessly challenging.

The Elements of Go

Go is a territorial war game, in which each of the 361 vacant intersections of the 19 x 19 line board under a player's control counts as one point of score, as does each enemy man captured. The winner is simply the player with the greater total score at game's end. The structural elegance of Go is such that all of its incredible strategic and tactical complexity derive from but a single basic rule and one special rule of play!

[The rules presented here are those of the Nihon Kiin. The Chinese rules differ slightly, but these differences are not important from our present perspective.]

The Mechanics of Play

1. Go is a two player game, with the stronger player always taking the White stones and the weaker player the Black. Equal players alternate colors in successive games. Each side has an unlimited supply of stones available and the number of moves required to complete a game is not fixed.
2. In non-handicap games, play begins with an empty board and Black always moves first, beginning anywhere he wishes. If White is much stronger than Black, Black will be allowed to place a number of handicap stones on prescribed points on the board before play begins, to compensate for the difference in their abilities. In such handicap games, Black's handicap stones represent his first move, so that White makes the first actual play.
3. The players move alternately, each in his turn placing one stone from his supply upon *any vacant intersection* of the board (not the squares), in accord with the two rules of Go. Once placed, the stones are never moved, except for those which are captured by the opponent and removed from the board by him and held as his prisoners.
4. Stones of the same color lying on adjacent intersections which are *connected by the lines on the board* form a group which lives or dies as a unit. Many such groups of both colors may exist on the board simultaneously although it is advantageous to attempt to connect friendly stones into the smallest number of groups possible.
5. A player may pass his turn whenever he wishes. When both players pass in succession, the game is over. (In practice, no one ever passes until the very late end game stage of play when the score is already decided.) After both players have passed, any remaining neutral points (called dame) on the board are filled by both players alternately. Next, abandoned stones are removed and all prisoners are filled into areas of the same color, and the score is counted. Only the difference in score between the two sides is significant, not its absolute magnitude.

Definitions

1. An immediately adjacent vacant intersection of the board is called

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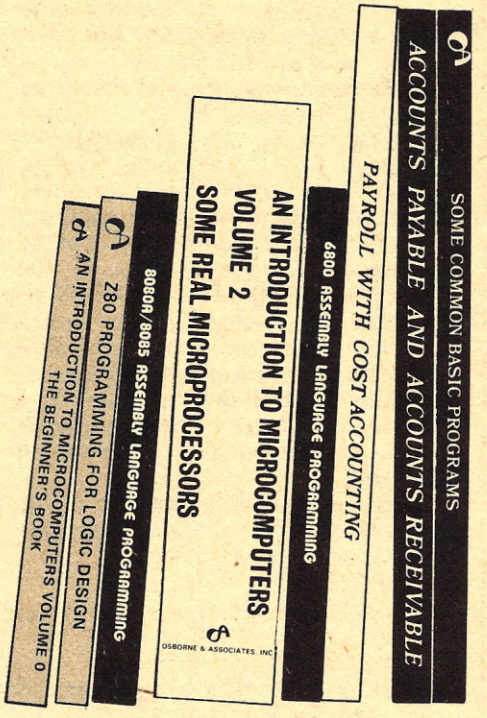

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a "liberty" for any stone or group of stones which is *connected to it by one of the lines on the board.*
2. A liberty which is entirely surrounded by stones of the same color is called an "eye" of that group.

The Basic Rule of Go

A stone may be placed upon the board or may remain on the board only if it has at least one liberty.

Implications of The Basic Rule

1. A "suicide" play, as a result of which the stone played would have no liberties, is prohibited. This does not preclude sacrifices, so long as each stone played possesses at least one liberty at the moment of its entry.
2. Stones are captured and removed from the board by the opponent singly or in groups, at the moment that the surrounding enemy stones occupy their last remaining liberty. Removal of the captured stones is considered as part of the capturing player's move, so that by capturing he may create liberties for a played stone which otherwise would appear to have none. When a player reduces an enemy group to its last remaining liberty, it is a customary courtesy to warn him of that fact by saying "atari."
3. Groups which contain only one eye are not independently safe, but groups which contain two or more distinct and separate eyes are forever immune from capture. Only such two-eyed groups may surround any territory and thus yield any score.
4. Territory belongs to one side if the stones which surround it are safe, and the opponent cannot invade that territory and form a live group of his own within it. Vacant intersections which are liberties for both sides simultaneously (dame) do not count as territory for either.
5. When opposing groups are fighting for survival in close quarters it is important to continuously maintain an accurate liberty count for each, since the side which is ahead will almost always win the fight if no external factors (such as Ko) intervene.

Application of the basic rule to the illustrative (and somewhat artificial) positions of Diagram 1 provides that White may play upon any vacant intersection of the board shown but that Black is prohibited from playing in four places. See if you can find them before reading further. All of these situations, except two show groups (sometimes consisting of only a single stone), are subject to immediate capture (i.e., have only a single liberty) and/or hopelessly trapped. Do you see the exceptions? Please consider each position illustrated as though it were alone on the board. If it were White's

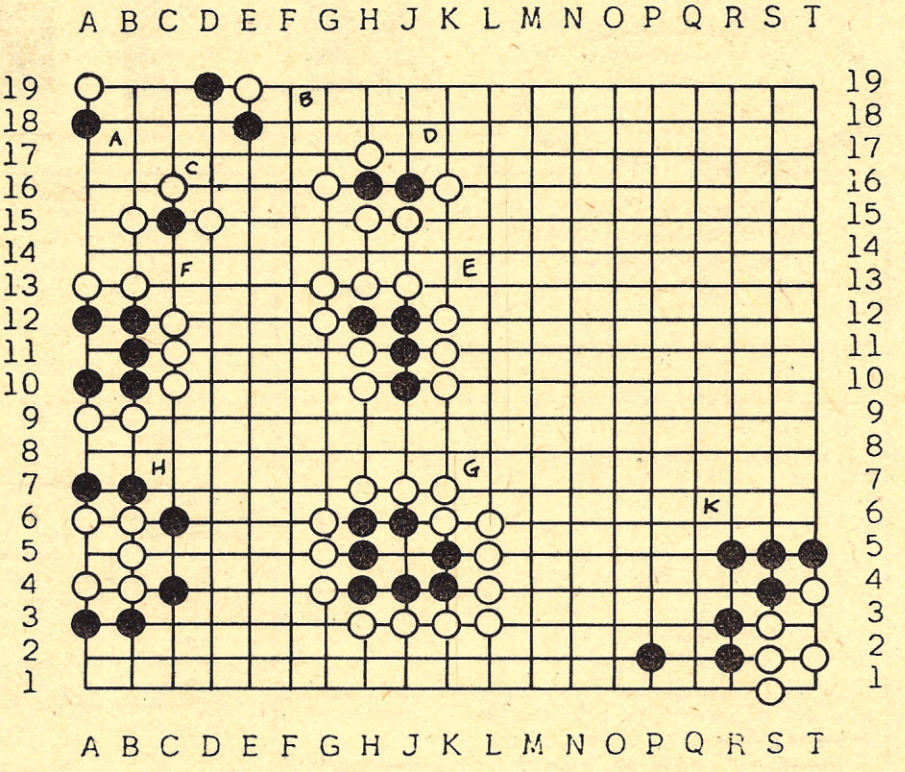


Diagram 1

turn to play, he could capture one Black stone in C, two in D, four in E, five in F, and seven in G by playing on the only remaining liberty of each group (at C14, J17, J9, A11, and J5, respectively). In F and G, that Black liberty is also an eye, but White can play there anyway. Why? (see implications #2 and 3). If it were Black's turn to play, he could capture one White stone unconditionally in A and B, but the capture in K via a play at T3 is governed by the rule of Ko (see below). The places in which Black may not play are on his own eye in F and G (suicide for the entire group), or on the White eye in H and K (suicide for that Black stone). In order to capture in H, Black must first fill the outside White liberty. In K, he must first fill the outside liberty and then win the Ko. It is important to note that White has only one true eye here. The Ko is a false eye, although some beginners may be fooled by it into thinking that the White group is safe. In an actual game, capture in situations like K will never be completed unless some external relief for these apparently hopelessly trapped stones materializes. If this situation remains unchanged to the end of the game, the White stones will then simply be removed by Black without further play (per Mechanics of Play #5, above). The only enclosed stones which can escape unaided from the diagrammed positions are the Blacks in C and E, both of which could readily achieve safety on an empty board by a Black play on their remaining liberty, thereby increasing their liberty count to 3. In D, a similar play by Black does not work, since it only increases the liberty count to 2. See if you can figure out how White can proceed to force Black's capture here if Black tries to run out in this manner. This type of position recurs frequently, and is called a ladder (shicho). It is one of the key tactical maneuvers in Go, which either occurs or is threatened in almost every game. (Hint: Each White play must reduce Black to one liberty.)

An important fact which must not be overlooked is that the capture of an enemy group is almost always effected by friendly stones which are at least partially unconnected themselves until the capture is consummated. Thus, in F the Blacks are surrounded by three separate White groups of 2, 2 and 3 stones respectively, while in D and H the surrounded stones are each oppressed by four enemy groups. If the surrounded stones were not so short of liberties as in these illustrations, these disconnections between the oppressers could become cutting points which may later serve as the mechanism for breaking through the encirclement. Since actual capture will almost always be deferred for reasons of efficiency of play, the potential opportunity for rescue will frequently remain for most of the game as a source of possible later exploitation, usually realized as a Ko threat (see below) although sometimes a direct breakout becomes possible.

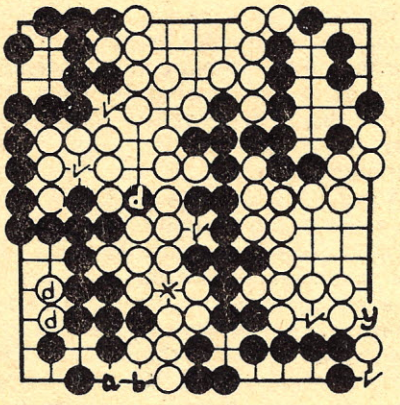


Diagram 2

The minimum territory which a group can enclose is two points, one for each of the two separate eyes which give it life, and there is a theoretical maximum territory based upon the minimum number of friendly stones required to control the entire board. In practice, territories as large as 30-50 points on the full 19 x 19 board are fairly common, although most are smaller. Diagram 2 shows the end of a small-board (13 x 13 line) game. The dame, which may be filled by either side, are checked or lettered. The point marked "x" is both a false eye and a necessary connection for White, since he must fill it immediately after the two dame marked 'a' and 'b' on the bottom edge of this group are filled in. The reason that the players fill the dame alternately should become clear from this illustration. As shown, each group must first fill the dame adjacent to its own stones here, because the other play becomes a meaningless Ko. However, if Black plays at 'a', White cannot immediately fill 'b', but must play at 'x' first, because to fill at 'b' would be a self-atari on 7 stones. Another necessary White connection in the lower right is marked 'y'. The abandoned stones of both colors are marked 'd'. As shown (including one Black stone captured by White during the course of the game), White has 21 points on the board less 2 prisoners, or 19 points. Black has 26 less 2 prisoners, or 24 points, so Black wins by 5 points. In practice, the count is usually simplified by simply filling the prisoners into territory of the same color (subtracting it from the opponent's score), and then shifting stones about within areas of the same color to form areas which are easily counted multiples of 10 (or 5, on a small board where the territories are smaller). The final difference is, of course, the same as a direct count would yield if the process is correctly carried out.

The Rule of Ko

If a *single stone* is captured and an immediate recapture by the opponent would exactly restore the prior position *on the entire board*, then the player losing that stone must first make at least one move elsewhere before recapturing. (This is the only exception to the rule that a player may play on any vacant intersection.) These "outside" plays are known as Ko threats.

In the abstract, as shown in positions A, B, and C of Diagram 3, Ko appears trivial. The positioning of the stones seems inefficient territorially, looks artificial in structure, and the capture or loss of a single stone is small. Despite these appearances to the contrary, Ko is of central importance to the game of Go. The reason for this apparent contradiction is that Ko never exists in the abstract, but instead is invariably deliberately created by one of the players as an often desperate mechanism to rescue or attack a compromised group of stones. The

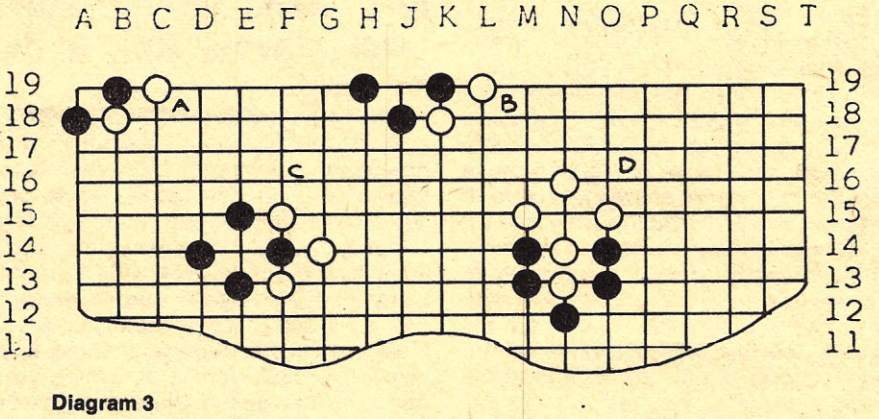


Diagram 3

winning or losing of the Ko will then either provide or kill a needed second eye, or establish or sever a necessary connection. Often, the result of the entire game will hinge upon the result of a single Ko fight, with the winner being the player who earlier created and carefully nurtured the larger supply of valid Ko threats.

Please note that, whatever its orientation on the board, Ko is identical in form. The only difference between A, B, and C is the truncation caused by the edges of the board. Position D is not Ko, because Black will capture 2 Whites by a play at N15. When White recaptures at N14, one White stone from the original position (at N13) will be missing and therefore there is no repetition of position. In this case, White can recapture immediately, if he wishes. Of course, recapture is not mandatory under any circumstances, nor is any other play in Go. The players are always at liberty to play anywhere on the board that they wish, in conformance with the two rules of Go.

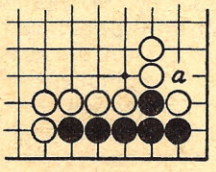


Diagram 4A

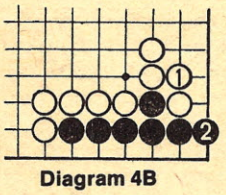


Diagram 4B

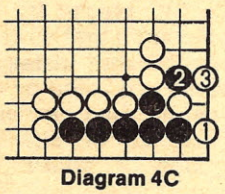


Diagram 4C

To illustrate a relatively simple situation in which a Ko might arise, consider Diagram 4A. As the position stands, Black is not yet alive in the corner, but he can live easily by playing at "a", capturing one White stone. However, this move is Gote (a move that White need not answer), because it clearly has no interaction with the rest of the board. Thus, if Black plays here at the wrong moment, he will in effect be allowing White to make two successive moves elsewhere on the board, and this is very bad for him. If Black allows White to play first at the same point (Diagram 4B), he can still live easily (but with less territory) by playing at 2. But this is an endgame play for White worth only 8 points, which would end forever any chance he has of killing the Black group, so he will also defer a play in this area until all of the larger plays elsewhere on the board have been made. The hidden threat in the position is shown in Diagram 4C. If and when White has succeeded in creating a sufficient supply of Ko threats, he need not wait for the endgame but can immediately play as shown, forcing Ko. Now, the entire Black corner's life depends upon his winning this Ko fight. The difference in score between Diagrams 4A and 4C (with White winning the Ko) is a surprising 30 points! Whether or not this Ko will ever actually come into being depends upon the structure of the remainder of the game, but both players will need to keep its potential existence in mind throughout. The player who loses a Ko will almost always get some compensation elsewhere on the board, as a result of the Ko threat which his opponent has ignored in order to win the Ko. If both sides play correctly, this compensation should be less valuable than winning the Ko, but the subtlety of Go is such that many a game has been lost because the virulence and importance of a subtle Ko threat was underestimated! In fact, the crucial importance of Ko arises largely from the impact of the Ko threats upon the rest of the board, except in those cases in which the life of a large group hinges directly on who wins the Ko itself. With two or more Kos on the board simultaneously, the complications can become extreme, and some three-Ko situations have led to a draw by infinite repetition of the sequence of Ko captures (a situation which the new Chinese rules no longer permit).

The strategy of Go is a curious blend of the obvious and the subtle which most beginners and many intermediate level players find quite baffling.

From a theoretical viewpoint, you now know almost everything there is to know about Go. Practically, of course, we haven't even begun to scratch the surface. Because the subject is so vast, what I will do now is to provide you with a few central strategic notions, expose you to a bit of Go's tactical magic, illustrate a representative opening, and provide a bibliography to which you can refer for a deeper understanding of these ideas.

An Introduction to Go Strategy

The strategy of Go is a curious blend of the obvious and the subtle which most beginners and many intermediate level players find quite baffling. The nominal objective of the game is the acquisition of territory, so that a simplistic approach to play would be to merely strive directly toward that end. It is, of course, possible to play Go in this manner if both players are so inclined, but no strong player would ever permit this. In practice, the territorial objective forms a kind of substrate upon which the more aggressive and interesting strategic and tactical motifs are etched. The point is that only life (safe, or two-eyed) groups can acquire and retain territory, so that much of the strategic planning and tactical execution in Go relates to the attack on enemy groups via threats to their potential eyespace, and the defense of one's own. The subtlety of Go also results partly from the fact that the board starts empty, so that the potential territories must be sketched out, groups created, and eyespace attacked and defended in a totally dynamic environment which is being created by the players move-by-move. Thousands of years of play have led to the realization that one attacks enemy stones by playing away from them, and that unless they are already desperately short of potential eyespace, moves made in contact with enemy stones serve only to strengthen them! Therefore, to attack on the right, you first press on the left and thus build the strength from which to later turn and strike on the right. In a typical Go game, the initial moves by each player attempt to sketch out territorial outlines, while simultaneously establishing potential lines of communication between friendly positions. The topology of the board space assures that the competing groups of both players cannot be connected simultaneously, so that conflict is assured. The defense of eyespace is obviously easiest in the corners where the board edges provide absolute security in two directions, so that the first moves are invariably made there, and then the positions spread out along the sides and into the center. Many times, large potential territories (moyos) are sketched out by one or both sides, but not with the realistic expectation of their retention. Rather, these moyos act to draw the opponent into invading them, so that he is fighting at a disadvantage within your sphere of influence, with the game's outcome usually riding on the result of the ensuing battles.

Diagram 5[13] shows the opening of a game between two strong amateur

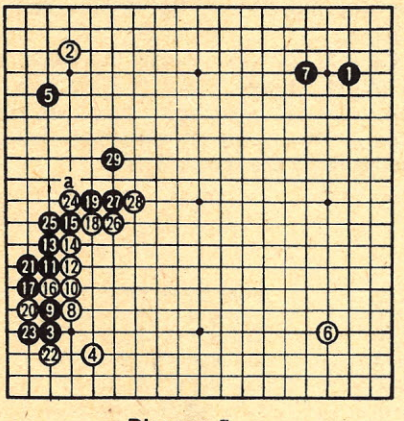


Diagram 5

players. It is typical primarily in the sense that it follows the general principle of corner, side, center for sequence of play. Note how the action shifts from corner to corner as the players struggle for overall board position. In the upper right, Black establishes a Shimari (corner enclosure) which gives him a strong local territorial and influence advantage. In the lower right, White temporarily "settles" the corner by playing on the handicap point, although this is only an influence play and does not directly claim any of the corner territory. In the upper and lower left, the players have divided the corners, and Whte 8 begins a well-known Joseki sequence in the lower left corner. White chooses this particular Joseki because it forces Black's response in a manner which enables him to build a powerful center-facing wall which coordinates ideally with his lower right corner position, and with which he hopes to control the game. In return, Black gets solid and almost secure territory along the left edge. Later, it will be Black's problem to invade White's moyo and attempt to reduce it. White's move 16 and the sacrifice play at 20 are designed to force Black's submissive reply at 23 to White 22, giving White a piece of Black's corner with Sente. White 24 is another clever sacrifice. Black 25 is absolutely forced, of course, but that's not the point of this move. Its real objective is to create Aji (residual threats) within the enemy position for later use. Black's 27 is over ambitious, and an error, although it could still be rectified at move 29 by playing at "a" to catch White 24. Now White, with Black's unwitting help, has set Black up for a very pretty trap, which only a strong player would see how to exploit. This will be explained below in Diagrams 8 through 10.

The Tactics of Go

The tactical complexity of Go exists on two levels. First, there is the straightforward complexity inherent in the thrust and counter-thrust of close combat ("contact fights")[10]. On this level, Go is comparable to Chess, as illustrated by the problems in Diagram 6[14].

In Problem A, White is to play and connect his trapped stones to his outer ones by capturing four blacks. Note that the White stones have only 2 liberties to Black's 3, so that a direct race to capture would lead to White's failure.

In Problem B, Black is to play and successfully invade White's territory on the right.

Please note that the examples given in Diagram 6 are necessarily quite elementary because Go is new to most of you, and more difficult problems might be more baffling than illuminating. Another caution which must be observed in approaching material of this kind is that it is clearly labelled here with the prescription for solution (e.g. Black to play and connect his stones). In an actual game, the identical situation (rarely) or one closely analogous might arise, but no one is going to formally announce its presence or that there is a winning sequence available. Both players must continuously evaluate the developing situations and search for the key plays which provide an advantage. The clearest distinction between strong and weak players lies in their ability to "read out" such complex tactical sequences, especially in advance of their actualization. But even the best players sometimes become embroiled in a fight whose exact consequences they haven't anticipated, and are then confronted with the dire necessity of finding the right move or meeting disaster.

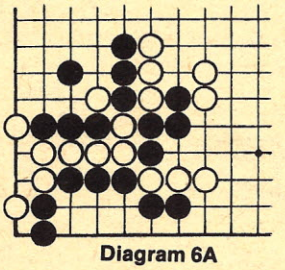


Diagram 6A

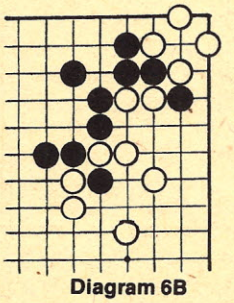


Diagram 6B

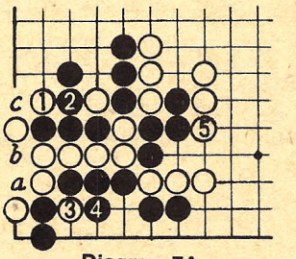


Diagram 7A

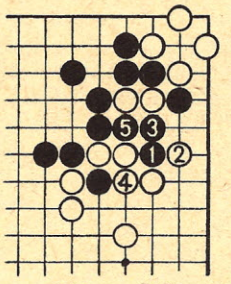


Diagram 7B

The solutions to the two independent problems presented in Diagram 6A and B are given in Diagrams 7A and B.

The solution to Problem A requires White to sacrifice two stones, in the order shown. Any inversion of the sequence fails! Both sacrifice stones serve to effectively add a liberty to White's stones by forcing Black to capture White 3 before he can approach. White 1 is atari on three Black stones so Black 2 is absolutely forced, giving White Sente to play 3 as well. The question is: Why is White 1 necessary? If you can see this unaided, you have the potential to become a strong player. The answer is that without White 1, Black can sacrifice a stone at "a", and when White captures at "b", Black "c" is atari, and wins. The same sequence occurs if White mistakenly plays at 3 first.

The solution to Problem B utilizes both of the seemingly abandoned Black stones. White 2 is the strongest response, but after Black 3 White cannot play at 5 because a Black response at 4 would then capture 5 stones. Incidentally, the 4 White stones in the corner are alive as shown, having two eyes, although the two edge connections will ultimately have to be made. This corner configuration is the absolute minimum number of stones which can make a live group! Does this shape look familiar? In Diagram 1C, if White captures the Black stone he creates this same shape, but in the center of the board. Although in the center it yields only one eye (as opposed to the two obtained in the corner), it is so extremely powerful in influence that there is a Japanese Go proverb which admonishes never to allow your opponent to achieve it. In the corner, of course, it has no such

impact on the rest of the board, and therefore has only local territorial value.

The higher level of tactical complexity in Go arises from the need for efficiency of play and the fact that Go is a game of accretion, with stones being continuously added to the board (except for those removed as a result of captures) throughout the game. Efficient play requires that each move bring the largest possible return, else you will fall behind your opponent. The players must therefore evaluate the whole board position before each move, and attempt to select the most valuable play at each turn. This means that both large scale strategic battles and local tactical fights will only be carried to the point at which the incremental value of the next move in that situation ceases to be the most valuable move in the current overall board position. Thus, most such situations will remain only imperfectly resolved for many moves, even though the life or death of large groups and/or many points of score may hinge upon the precise manner of their eventual resolution. The higher level of tactical complexity in Go is realized via the exploitation of these unresolved situations in interaction with newly developing ones. Strong players make moves which exploit the whole board situation to the fullest, and this often means taking advantage of threats arising from the consequences of prior errors, such as a previously abandoned and apparently hopelessly trapped group of stones. As the game develops, several such situations may exist on the board and deep traps have been sprung in which a single play affected two (or more!) key fights simultaneously.

Caught on the horns of such a dilemma, a player can at best opt to win the more valuable fight, and lose the other. This kind of situation is illustrated in Diagrams 8-10.

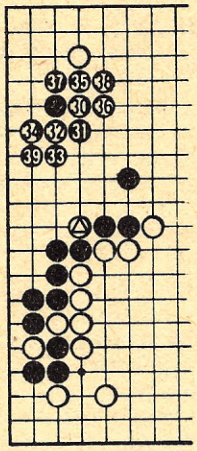


Diagram 8

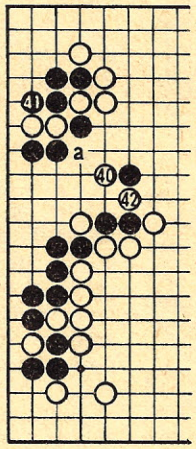


Diagram 9

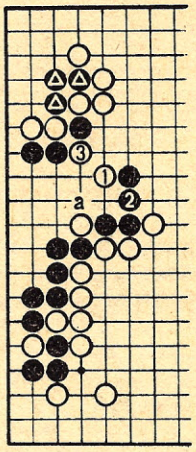
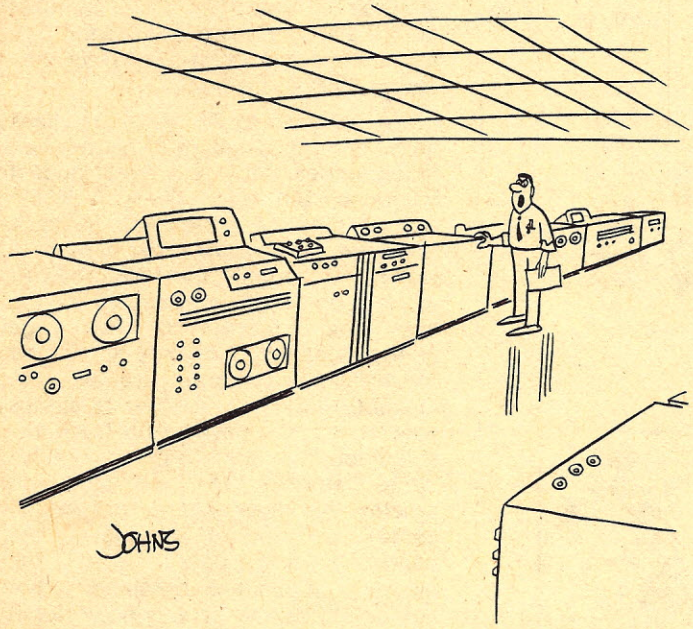
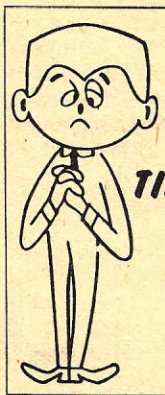


Diagram 10



"I STILL SAY THIS IS A CLOTHES DRYER!"



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Although it is quite possible to get hopelessly behind in Go, in most cases, unlike Chess, a substantial potential for a last moment reversal exists and this helps sustain interest to the very end.

White's clever exploitation of Black's opening error in Diagram 5 begins with the Joseki sequence of 30 and 31 in diagram 8, but then instead of playing the usual Joseki move at either 36 or 37, White cuts at 32, then sacrifices a second stone at 34. Up through Black 39 the plays all seem natural and good, yet Black is now "busted" because of the Aji of White 24 (marked △). The trap is sprung and the coup de grace delivered by White 40 in diagram 9.

If Black answers as he did with 41, White 42 captures the two Black center stones and gives White an overwhelming influence in the center. If instead Black saves the center with the sequence of Diagram 10, White connects his corner stones and leaves Black with the impossible problem of both saving his 3 corner stones and of preventing White "a", which would leave the 4 Black center stones floating without eyes. This particular game is now effectively over, unless White later makes a compensating blunder. It is not unknown for a later countertrap in the same game to again reverse the tables, and this is one of the beauties of Go. Although it is quite possible to get hopelessly behind in Go, in most cases, unlike Chess, a substantial potential for a last moment reversal exists and this helps sustain interest to the very end. The tactics of Go are so vast that certain important recurrent tactical maneuvers (called tesuji) have been extensively cataloged. These are efficient (and sharp!) tactical plays, which make the optimal exploitation of a local situation. The nearest analogy to tesuji in Chess that I can think of would be a catalog of forks, sacrifices, pins etc., if such were to exist. Among the tesuji are a wide range of sacrificial plays, those designed to form or destroy shape, establish or cut lines of communication, etc. The problems in Diagram 6 make use of tesuji in their solution, and the concepts involved in tesuji are closely related to the notions of efficiency and "shape", which are both central and unique to Go.

The Endgame in Go

Master Go games are usually very close, and players at this level will resign if they calculate that they are more than 10 points behind without clear potential for recovery. In handicap games in which the handicap is accurately chosen, White will almost invariably be behind until the end game. Although endgame plays usually range in value from a maximum of about 8 points down to a mere 1 (or even a fractional value for Ko), many games are won or lost there, long after the big battles have been decided. Many a player has gone into the Yose (endgame) comfortably ahead, only to have his opponent win via clever exploitation of Sente (the initiative) throughout a long series of small yose plays. Here, too, there are many opportunities for subtlety, and even some major tactical coups.

Seki

A Seki is a form of local stalemate in which opposing groups having only one eye, or no eyes at all, share a number of mutual liberties. Under these circumstances, neither side can attack the other, since the move on a shared liberty which puts the enemy into atari would do the same to yourself, but with the opponent's turn to move coming up! If the external

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enclosing stones are safe, neither side will play within the Seki, and the position will remain unchanged to the end of the game. No points accrue to either player as a result of Seki. If one side has an eye and the other does not, Seki will not result, but one or the other will die depending upon the number of external (not shared) liberties available to each. Seki is sometimes resolved with the death of one side on the other if the mutual liberties are filled as Ko threats, when the value of the Ko is greater and one of the players is out of Ko threats. This follows the general principle in Go that nothing is secure or decided until after the game has ended and the score has been counted! The major importance of Seki is that it usually comes into existence under duress as a last-ditch strategem to save an otherwise lost group. In this sense, it is much like Ko. Especially when invading enemy territory, Seki is almost as good as life because the main reduction in enemy score comes from the sum of friendly and enemy stones added within what was his space. If, say, 10 stones of each color are added to make a Seki, his territory will be reduced by at least 22 points, whereas if the invaders die his score is unchanged. If the invaders live, the few points of territory they might acquire will usually be a trivial addition to the loss occasioned by the added stones.

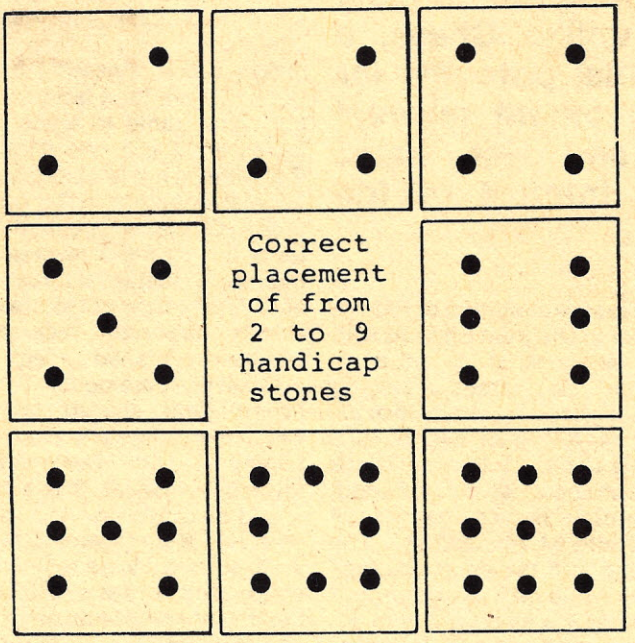

Diagram 11

The Handicap System in Go

Because of the very wide skill range of Go players, a remarkable handicap system has evolved which quite accurately acts to equate players on different levels thus enabling them to have enjoyable games together. Experience has indicated that each consistent incremental difference in final score of about 10 points between two players corresponds closely to one handicap stone, up to a maximum of nine (9) stones. Differences in playing strength much beyond this don't usually lead to an enjoyable game, and this 9 stone difference is at least comparable to Queen odds in Chess! The correct placement of the handicap stones, assuming that Black is sitting at the bottom, is as shown.

Note that there is no such thing as a one stone handicap since this is simply first move, and in this case the weaker player is allowed to play anywhere. If the players are equal in ability, or in a non-handicap (e.g. championship) tournament or match, the players alternate colors in succeeding games, and the player of the White stones is awarded 5½ points of "Komi" added to his final score to offset the advantage of Black's moving first. Note that the extra ½ point in the Komi makes draws impossible, except for rare repetitive situations such as the triple Ko described earlier. Adjustment of the handicap by one stone at a time is usually made if either player wins three successive games, until a handicap is found that produces an approximately even split. Go ratings are based upon the handicap system, with amateur rankings separated by one handicap stone for each level. This way, any two rated players who meet for the first time will immediately know the proper handicap to make their match most interesting. For example, if a 1 Kyu plays a 3 Kyu, the latter takes 2 stones. A 7 Kyu playing a 6 Kyu takes Black.

It should be carefully noted that the handicap stones do not directly confer any territory upon Black. Rather, they are placed upon key points of influence on the board, so that the advantage they confer is only transitory. If properly utilized, they can result in the stated increment of 10 points of score per stone, and this has been proved by experimental handicap games between equally rated master players. The handicap points are so valuable that their early occupation is now often common during the Fuseki stage of even games, and this strategy was the key element in the Shin Fuseki revolution of the 1930's mentioned earlier.

Programming Personal Computers to play Go

At least some of the reasons why constructing a computer program to play Go is difficult should now be clear. In fact, it is quite reasonable to ask if the task is even feasible on small computers, given currently available technology. Fortunately, the answer is yes, because of still another aspect of Go which we have touched upon earlier but reserved to discuss at this moment. This saving grace is the fact that Go is often played on smaller boards than the full 19 x 19 lines, primarily to reduce the time required to complete a serious game from 1-3 hours to perhaps 30 minutes or less. This reduction in scale is accomplished without doing any essential violence to the basic premises of Go (although it does shift the strategic/tactical balance considerably in favor of the latter as the board gets progressively smaller), and this constitutes yet another of its advantages over rivals like Chess. The small board also has special virtue in teaching Go to beginners, since the shorter time frame helps enable better overall perspective and unites the opening, middle game, and endgame in more obvious fashion.

The small board sizes most often chosen are 9 x 9, 11 x 11, and 13 x 13 lines, although even 7 x 7 lines generate a non-trivial and non-deterministic game, and a real programming challenge. The reduction in scale to 9 x 9 from the full 19 x 19, for example, reduces the scope of the board from 361 intersections to 81, or to 22.4% of the original. This reduces the size of the move tree greatly, and

permits exact calculation of alternatives to a much greater relative depth, and in conjunction with some of the criteria for move feasibility outlined above (Joseki, tesuji, shape) and a few additional concepts which are given in the references, should make it possible to construct a reasonably strong program on most personal computers. At this size, the difficulty in programming is at least equivalent to that of a complete Chess game, and is not to be taken lightly unless you're a programming superstar! Any reasonable Go-playing program will undoubtedly contain subroutines for such recurrent functions as counting liberties, making good "shape", deciding whether to run or make eyes, making/killing eyes, as well as for evaluating "influence" and estimating potential territory. Each of these constitutes a separate problem of independent theoretical and practical importance, and would serve well as a starting point for the overall task. Unlike Chess problems, Go problems are always feasible in and representative of actual play, and it is no trivial task to produce a program which can perform any one of these functions on a high enough level to solve the corresponding problems. Most published Go problems will fit a 9 x 9 board, so that the ability to solve these is a readily available criterion of success for your efforts.

The individual who succeeds in producing a Go program which can defeat a strong human opponent on even a small board will have a product with real commercial potential, as well as the satisfaction of a pioneering achievement of no mean scope.

No attempt will be made here to even indicate the methods for most efficiently accomplishing the ultimate fundamental task of a Go-playing program — the selection of the move at each turn which best satisfies the overall territorial (strategic) objective within the context of the current tactical situation — because these haven't yet been worked out, although the result will obviously require an integration of the above subroutines, and then some.

The best Go-playing computer programs of which I am currently aware were created by Bruce Wilcox[18], on an Amdahl 470 as an exercise in artificial intelligence, by Jon Ryder[19] on a PDP-10, and by Al Zobrist[20]. Bruce's program is still "only" in the 20 Kyu range, but he is attempting the full-board problem head-on! Whatever the approach, there's little question that the individual who succeeds in producing a Go program which can defeat a strong human opponent on even a small board will have a product with real commercial potential, as well as the satisfaction of a pioneering achievement of no mean scope.

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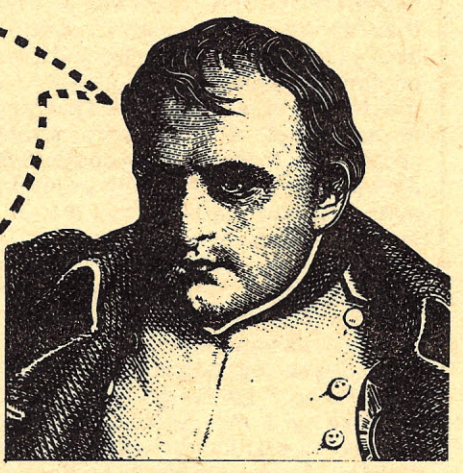

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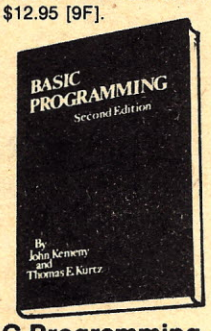

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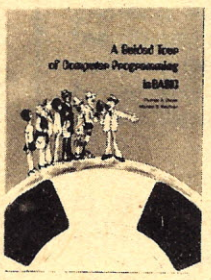

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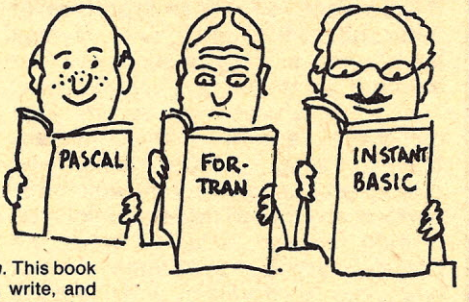

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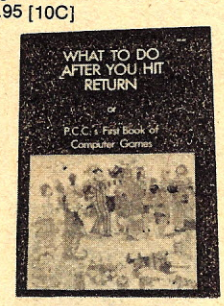

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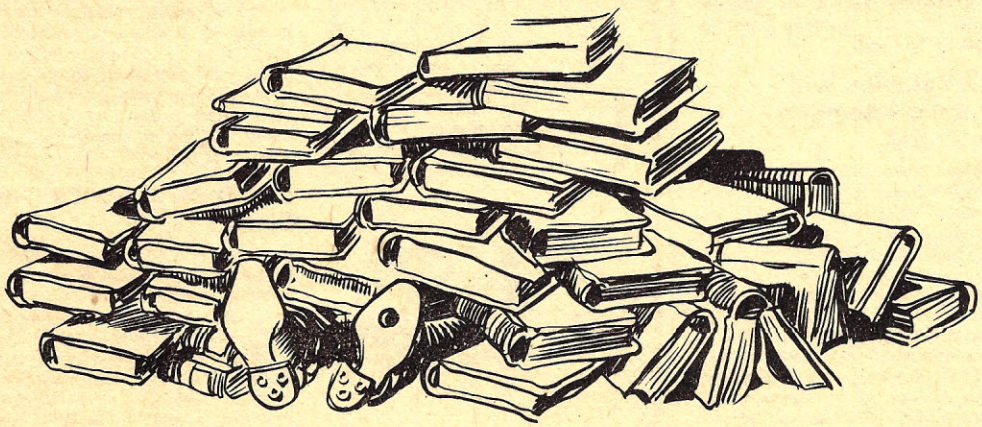

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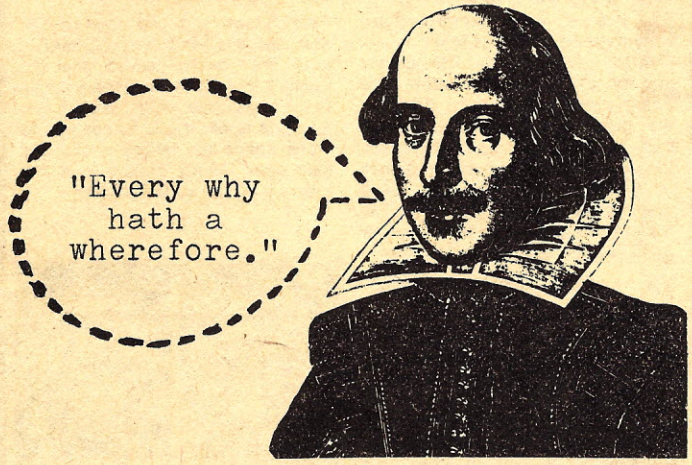

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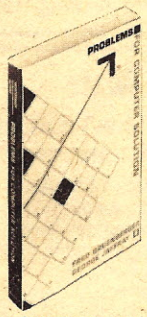

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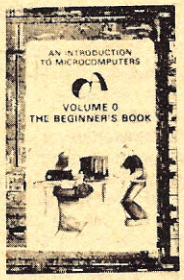

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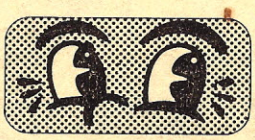

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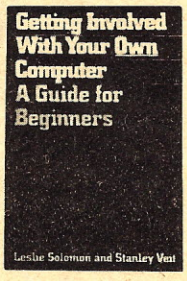
Robert Moody. Tells what personal computers are and what you can do with them in a light entertaining style. Starts with the basics and then covers the technical aspects such as how a personal computer is constructed and how it works. Includes such things as home protection, keeping track of budgets and bills, game playing, inventory management and tax calculations. 139 pp. $4.95 [10T]

Consumers Guide to Personal Computing and Microcomputers

Freiberger and Chew. Here are two valuable books in one: an introduction to the principles of microcomputers that assumes no previous knowledge on the reader's part, and a review of 64 microcomputer products from over 50 manufacturers. Also, extensive illustrations and best-buy tips for each type of microcomputer product. 176 pp. $7.95 [10U]



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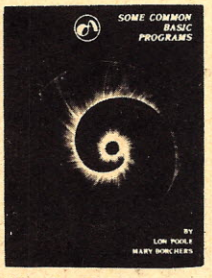

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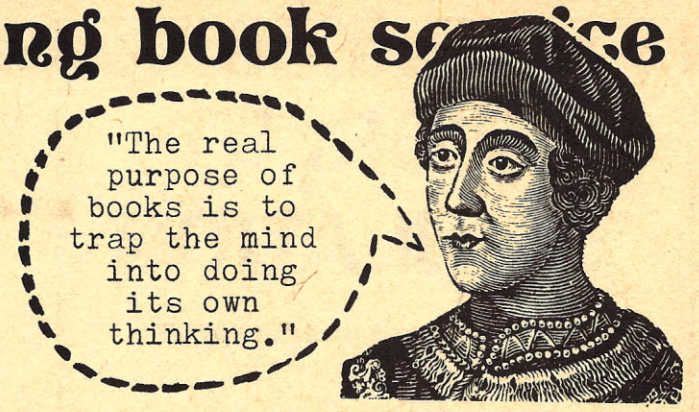

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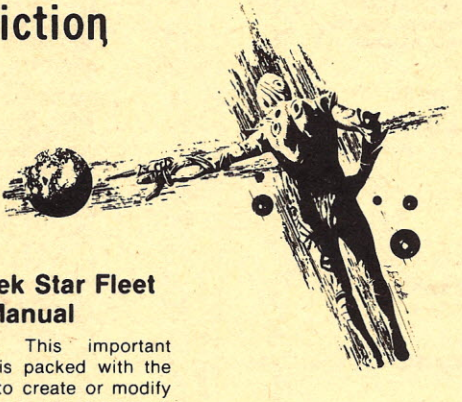

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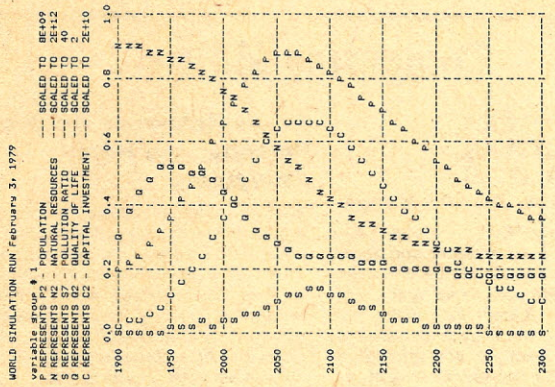

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NAT RESOURC	FOOD RATIO	NAT RESOURC USAGE
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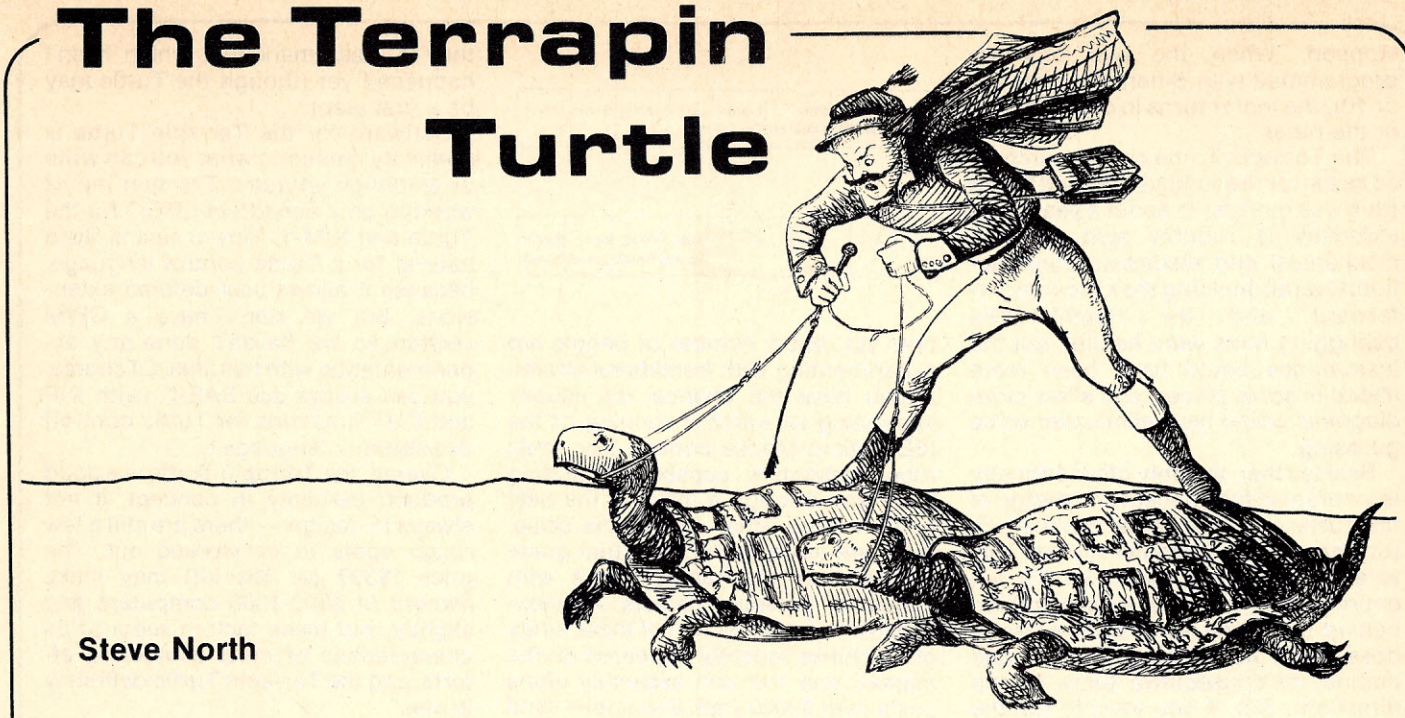
Our Face is Very Red Dept.

Speed Reading Made Easy

In the January 1979 issue, we presented a marvelous application for the PET by Tom Rugg and Phil Feldman called "Speed Reading Made Easy." The article had a line-by-line description of the program, sample output, suggestions for adapting it to other machines — everything in fact, except the program itself. We are very sorry! The program is printed below. Team this up with pp 132-133 of the January issue and you've got a really dynamite application.

```
100 REM: TACHISTOSCOPE
110 REM: COPYRIGHT 1978 BY TOM RUGG AND PHIL FELDMAN
120 T=.1
130 J=T*60:B=147
140 L=50
150 DIM T$(L)
160 C=0
170 READ R$
180 IF R$="XXX" THEN 250
190 C=C+1
200 IF C>L THEN PRINT"TOO MANY DATA STATEMENTS":END
210 T$(C)=R$
220 GOTO 170
250 R=RND(-TI)
260 PRINT CHR$(B)
270 PRINT"**** TACHISTOSCOPE ****"
280 PRINT
290 PRINT"THIS PROGRAM IS DESIGNED TO"
300 PRINT"IMPROVE YOUR READING SPEED."
310 PRINT
320 PRINT"I'LL BRIEFLY DISPLAY A SHORT"
330 PRINT"PHRASE, AND YOU TRY TO READ IT."
340 PRINT
350 PRINT"TYPE WHAT YOU SEE, AND I'LL TELL"
360 PRINT"YOU IF YOU WERE RIGHT."
370 PRINT
380 PRINT"WE'LL START AT";T;"SECONDS."
400 FOR K=1 TO 5:GET R$:NEXT:PRINT
410 PRINT"PRESS ANY KEY WHEN YOU'RE READY."
420 GET R$:IF R$="" THEN 420
430 R=INT(C*RND(1))+1
440 IF R=P1 OR R=P2 OR R=P3 THEN 430
450 IF R=P4 OR R=P5 THEN 430
460 PRINT CHR$(B):GOSUB 840
465 FOR K=1 TO 1500:NEXT K:IF J<2 THEN 800
470 PRINT:PRINT:PRINT T$(R)
480 S=TI
490 IF TI-S<J THEN 490
500 PRINT CHR$(B)
505 FOR K=1 TO 500:NEXT K
510 PRINT:PRINT:PRINT:PRINT
520 PRINT"WHAT WAS IT?"
530 INPUT R$
540 PRINT
550 IF R$<>T$(R) THEN 700
560 PRINT" THAT'S RIGHT!"
570 J=J-3
580 IF J<1.2 THEN J=1.2
590 PRINT
600 P1=P2:P2=P3:P3=P4:P4=P5:P5=R:PRINT
610 PRINT"THE NEXT ONE WILL BE DISPLAYED"
620 PRINT"FOR";J/60;"SECONDS."
630 PRINT
640 GOTO 400
700 PRINT"NO, THAT'S NOT IT.  IT WAS"
710 PRINT:PRINT"'";T$(R);"'"
720 J=J+3
730 IF INT(J/3)<>J/3 THEN J=3*INT(J/3)
740 GOTO 590
800 PRINT:PRINT:PRINT T$(R);CHR$(147)
810 GOTO 505
840 PRINT"-----------":PRINT
850 PRINT:PRINT:PRINT"-----------"
860 PRINT CHR$(19)
870 RETURN
910 DATA"AT THE TIME"
920 DATA"THE BROWN COW"
930 DATA"LOOK AT THAT"
940 DATA"IN THE HOUSE"
950 DATA"THIS IS MINE"
960 DATA"SHE SAID SO"
970 DATA"THE BABY CRIED"
980 DATA"TO THE STORE"
990 DATA"READING IS FUN"
1000 DATA"HE GOES FAST"
1010 DATA"IN ALL THINGS"
1020 DATA"GREEN GRASS"
1030 DATA"TWO BIRDS FLY"
1040 DATA"LATE LAST NIGHT"
1050 DATA"THEY ARE HOME"
1060 DATA"ON THE PHONE"
1070 DATA"THROUGH A DOOR"
1080 DATA"WE CAN TRY"
1090 DATA"MY FOOT HURTS"
1100 DATA"HAPPY NEW YEAR"
9999 DATA XXX
```

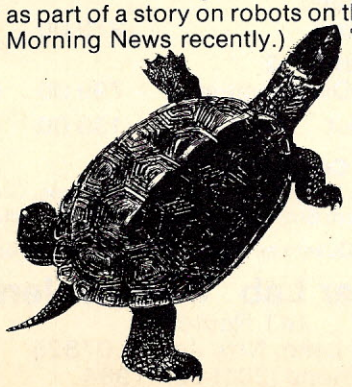
The Terrapin Turtle



Steve North

Always on the lookout for anything new and novel that can be hooked up to a computer, we were immediately interested when we heard about the Terrapin Turtle. This robot device is a small bubble-shaped mechanism which rolls around on the floor and performs other tricks under the control of your microcomputer system, via a cable.

The Terrapin Turtle was inspired by Seymour Papert's turtle devised at MIT's AI Lab. It can move forward, turn in increments, and leave a visible trail. The purpose of a very small robot like the Turtle may not be immediately apparent. Obviously, it's not going to serve martinis when you get home from work, or do any vacuuming. However, the turtle is useful for some educational applications, since it can be physically observed, as opposed to bits inside a box which flip on or off. It's not such a great leap for a child to understand how to give the turtle instructions to move in a pattern if he can break down the steps in tracing out the pattern himself.[1] The Terrapin Turtle also deserves attention because of the growing interest in personal robotics. (I was slightly astonished to see a brief clip of the Turtle rolling around on the floor as part of a story on robots on the CBS Morning News recently.)



The Terrapin Turtle is built around two reversible electric motors which are joined together rigidly with threaded rods. Brackets mounted on the motors support a base plate which sits horizontally near the floor and a circular PC board which fits near the top of the unit. A solenoid, 2" speaker, and two "turtle toes" are mounted on the base plate. The turtle toes are actually small black knobs which help the turtle stay upright by counteracting the inertia produced when starting or stopping. Locomotion and support for most of the weight are provided by two 4" diameter rubber wheels which fit onto the motor shafts. The electronics for the Turtle including two red LEDs ("eyes") are contained on the PC board. Wires run off the board to motors, speaker, and pen solenoid to control them. Finally, a clear plastic dome covers the entire unit; it is supported at the top by a rod which is connected to four microswitches on the PC board. When the Turtle runs into an object, its dome is pushed in a certain direction; this activates the appropriate one or two touch sensor switches allowing some rudimentary feedback from the turtle to the host computer.

The speaker, mentioned above, plays a high or low tone or is silent under command from the computer. This allows the Turtle to make a few sounds, handy for frightening the family pet. The solenoid manipulates an ordinary ballpoint pen refill, allowing you to write on the floor if you want. (Normal people may wish to put a piece of paper underneath the Turtle first.) While we had hoped, with the usual wild optimism, that this might be some kind of Poor Man's Plotter, such is not the case. The solenoid locks very firmly in either up or down position, and the pen refill itself doesn't have much give, so the entire pen mechanism must be adjusted *very* precisely for the pen to fully contact the floor without making the Turtle impale itself. Never being one much for acts of ultra physical coordination, I managed to get the adjustment just a shade too high from the floor after the better part of an hour, and then tried to take the easy way out of forcing the pen down a tiny fraction of an inch with a pair of pliers. Regrettably, this was definitely not the right way to attack the problem. This was brought home to me as I was cleaning all the ink off the inside of the turtle, after I pulled the end of the pen cartridge by accident. The problem of the pen adjustment is complicated by the necessity of taking one of the motors off to make the smallest change. On the other hand, Terrapin assured us that the Turtle pen really does work, and offered to send Turtle-generated plots, but we still feel that this aspect of the design needs a little reworking for less able Turtle owners. (We wonder if a felt or nylon tip pen, as used in the original Papert turtle, wouldn't be a better alternative.)

Communication between Turtle and computer is done with an 8-bit parallel I/O port. (+8 volts must also be supplied to the unit.) The various bits in the I/O port are related to different areas of the Turtle's functioning. Programming it to do some action is merely a matter of setting the correct bits. Diagram A shows the function of each bit in the I/O port.

The only feature which requires a little more explanation is the motor control bits (two for each motor). When the bits are both programmed with the same value (00 or 11), the motor is

stopped. When the two bits are programmed with different values (01 or 10), the motor turns in one direction or the other.

The Terrapin Turtle can be purchased as a kit or assembled. We tried the kit (this was our first in about a year). The assembly is roughly split between mechanical and electronic construction. Overall, building the kit is straightforward, and the Heathkit-style debugging hints were helpful, but the instructions could have been more liberal in some places, and a few more diagrams would have eliminated some guessing.

Besides that, the only other difficulty is inherent in the concept and design of the Turtle — the umbilical cable which runs back to the computer system. This is a 15-conductor cable, so it's not entirely limp, and it's always trailing behind the Turtle, so to some extent it does limit its mobility (range and number of consecutive turns in one direction). But, if you want to run the Turtle under the control of a separate microcomputer system, it's the only practical means of control. Radio control is probably still too complex and expensive.

Incidentally, an alternative to this design (and probably the way we'll see these kinds of devices develop in the future) is to build the computer right into the robot. As far as I know, there are no commercially available products of this type for the personal

Tone Hi/Low	Horn On/Off	Pen Up/Dwn	Lights On/Off	Left 1	Motor 2	Right 1	Motor 2

X	X	X	X	Back Touch	Front Touch	Left Touch	Right Touch

user yet, but a number of people are experimenting with homebrew efforts. If you have the chance, it's usually interesting to watch a running of the IEEE Micro-Mouse contest (for small robot-computers capable of finding their way through a maze in the best time). At the other end of the scale, there are more useful industrial grade robots with mechanical arms with hands for grasping objects. An inexpensive low-end version of these kinds of machines recently appeared on the market, and the arm assembly alone costs over $2000 (talk about an--- and a leg!) There are several impediments to the development of personal robot devices, even very rudimentary ones. First, they require a lot of expensive mechanical engineering and machining; there just aren't many computer hobbyists with $50,000 worth of machine shop equipment in their basements who also have reasonable skill in designing precision mechanical apparatus. Further, the cost of these products won't come down much until they're mass marketed, which hasn't happened yet (though the Turtle may be a first step).

Software for the Terrapin Turtle is presently limited to what you can write or scrounge yourself. Terrapin Inc. is working on a version of LOGO for the Turtle and KIM-1. Tiny-C seems like a natural for a Turtle control language, because it allows user-defined extensions, but we don't have a CP/M version so we haven't done any experimentation with this idea. Of course, you can always use BASIC (with INP and OUT functions for Turtle control) or assembly language.[2]

Overall, the Terrapin Turtle is a good product, certainly in concept, if not always in design — there are still a few rough spots to be worked out. The price ($300 for the kit) may make owners of $600-1000 computers gag slightly, but these factors seem to be characteristic of most pioneering efforts, and the Terrapin Turtle definitely is one.

For more information, contact: Terrapin Inc., 33 Edinborough Street, Sixth Floor, Boston, MA 02111.

1. McLean & Pagano, "Turtle Geometry Without Hardware," *Creative Computing*, Vol. 1, No. 00. (Also, *Best of Creative Computing, Vol. 1).*
2. In the now out-of-print booklet "Basic Applications Programs — Plotting" published by DEC, David Ahl wrote simulations for most of the LOGO commands in BASIC. These will eventually be published in *Creative Computing.*

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Throw Away Those Index Cards! Radio Shack's Information System

Steve Gray

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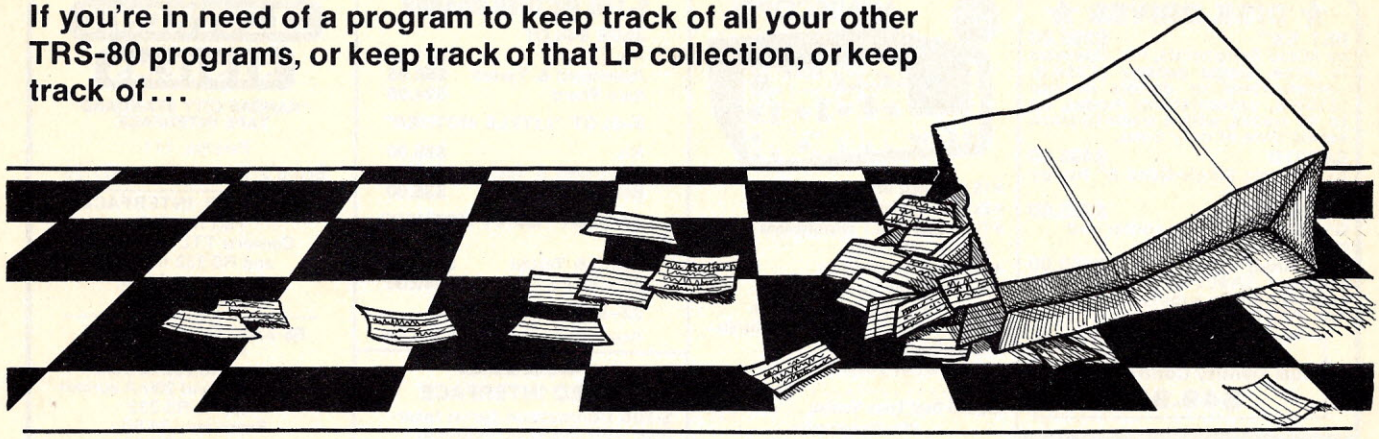


In-Memory Information System This three-cassette $19.95 package from Radio Shack is, according to the TRS-80 catalog, "A collection of three assembly-language programs that can virtually replace any small index-card system. It will file inventory, name and address lists, phone numbers, investment portfolios and more." The Level-I programs are on one side of the cassettes, Level-II on the other.

According to the overview, the system "is designed to allow you to create, save, retrieve, modify and sort any type of data. Data can be made up of any characters: letters, numbers, special characters or any keys on the keyboard."

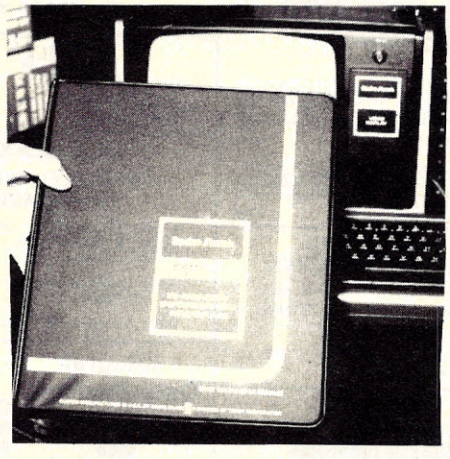
The nine-page manual provides an overview, tells what data files are and how to prepare them, how to use the three programs, and shows how to create large data files that require more than one data tape.

The **Initialization** program is for entering both the fixed information (record length, key length and field names) and variable information (data). The key is the first field, the one used to sort and retrieve data with. Each field, including the key, can be up to 19 characters long.

After you've entered all the information in the fixed and variable fields, you store it on one of your own tapes, as no blank cassettes are furnished with this package.

The **Retrieval and Update** program, after being loaded, first asks you to read in the data from the tape you've recorded. Then it displays a menu, which is a list of things you can do: add more records, obtain a list of the keys, look at or update or delete records, record data, or end the run.

The menu says that if you want to look at, modify (update) or delete any records, type an S. Then, to access a record, you type its key. The computer displays all the information stored in the records that start with that key. You can change or delete any part of this record, or move on to the next record.



The **Sort** program puts the records in order according to their keys. You load your data tape, press ENTER, and the sort is then performed automatically. As the manual says, "The advantage of sorting is that data is easier to find when it is in some ordered arrangement."

The sort can be on an alphabetic field, or a numeric field, or on a field made up of characters that are neither letters nor numbers, and in which, for sorting purposes & precedes $, which comes before #, etc. You can't use a semi-colon because that's for separating data items.

I'd decided to keep track of the Radio Shack software, so when the Initialization tape was run and the screen asked for record length, I entered 35, which is 7 for the catalog number, plus 20 for the description, 5 for the price, and 1 for each of the three fields. When the key length was asked for, that was 7, the catalog number. The screen then asks for the names of the fields and after that the data.

When I typed in the description of 26-1502, which is In-Memory Information, the program asked me to REDO, because I'd exceeded the field length of 20. I should have counted more carefully. The program lets you vary the length of any field except the key field, but once you've decided on the maximum length of a field, you can't go beyond that. So count carefully.

Then you can save the information by recording it on a blank tape. That's all there is to Initialization, unless you made a mistake and want to record the data again.

In the Retrieval and Update program, when the menu came up, I typed A for adding records, added a couple of new software items to the list, and then recorded this latest version.

With the Sort program, when the sort is finished the screen says SORT COMPLETE, and adds that if you wish to save the sorted data, load a data tape and record.

The manual ends with a section on large data files. If you have large amounts of data, you have to use more than one tape. So if it's an employee file, for example, you divide the alphabet into as many parts as needed. The manual then shows how to compute the number of records your computer can store at one time, by dividing record length into available RAM.

This is a good information system to use if you have a fair amount of data to keep track of, say at least several dozen items. For fewer items than that, a card file would be adequate and would require less manipulation. Even with large files, it all comes down to this: how much time would you save by computerizing them, and are the files important enough to you to make the computerizing worthwhile? If the answers are "a lot" and "yes" then you should check out IMIS, Radio Shack's In-Memory Information System. ■

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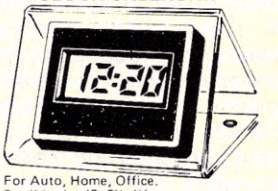

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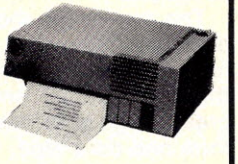

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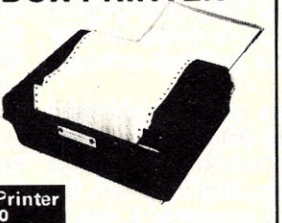

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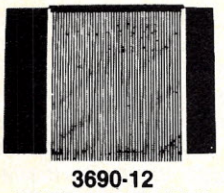

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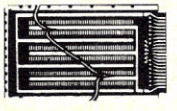

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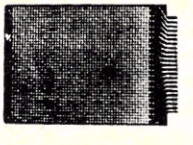

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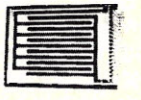

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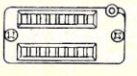

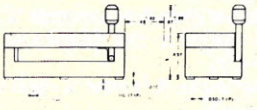

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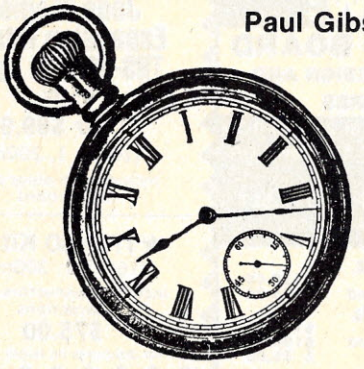
Stopwatch: A Tiny C Program

Paul Gibson



The January 1979 issue of Creative Computing (pp 68-71) had an article about a unique new structured programming language, **Tiny C.** The article contained a description of a program, Stopwatch, however no program! Well, here it is at last along with the description.

If readers are interested we have several additional Tiny C programs. Let us hear from you.

Tiny C is available in 8080 and PDP-11 versions from Tiny C Associates, Box 269, Holmdel, NJ 07733.

```
STOPWATCH
[
  INT K;MAGIC;N;TIME
  PL"THIS IS A STOPWATCH"
  PL"TYPE 'G' TO GO"
  PL"TYPE 'S' TO STOP"
  PL"TYPE 'T' TO TELL TIME WHILE STOPWATCH IS RUNNING"
  PL"TYPE 'X' TO END PROGRAM"
  PL"";PL"";PL""
  MAGIC=31          /* MAGIC IS A MAGIC NUMBER WHICH TELLS HOW
  WHILE(1)[        /* MANY TIMES TO GO THRU THE WHILE LOOP BEFORE
    K=GETCHAR     /* COUNTING ANOTHER SECOND
    IF(K=='G')[     /* -------- START STOPWATCH -------- */
      TIME=-1
      N=MAGIC/2
      WHILE(1)[
        N=N+1
        IF(N==MAGIC)[
          TIME=TIME+1
          N=1
          IF(CHRDY()=='S')BREAK
          IF(CHRDY()=='T')[
            GETCHAR;PN TIME
          ]
        ]
      ]
    ]
    IF(K=='S')[
      PL""
      PN TIME
      PS" SECONDS"
      PL""
      PL""
    ]
    IF(K=='X')BREAK
  ]
]
```

This is a program that imitates a stopwatch. You can start the stopwatch, stop it, get the present number of seconds while it is running and end the program by typing certain letters on the keyboard.

Detailed description

After naming the variables, the instructions are printed on the screen. Then MAGIC is set to 31. MAGIC is a magic number that determines the accuracy of the stopwatch. It takes one second to go through the inner WHILE loop 31 times; so every 31 times through the loop, another second is counted. At the beginning of the outer WHILE loop, the computer comes to the statement:

K=GETCHAR

When the computer comes to a GETCHAR, it stops and waits until a character is typed. When a character is typed, it puts that character in K. The character will most likely be 'g' (to start the stopwatch) which will make the next IF statement true.

TIME is then set equal to zero. The next statement reads:

N=MAGIC/2

That will set MAGIC to 15 (tiny c doesn't have decimals). Then it will only have to go through the inner WHILE loop fifteen times before counting the first second. When a half-second has passed, the computer will count one second. The purpose of this is to round the actual time to the nearest second. If the actual time is between ½ and 1½ seconds, the computer will count one second. If the actual time is between 1½ and 2½ seconds, the computer will count it as two seconds.

In the beginning of the inner WHILE loop, N is set greater by one. Eventually, by going around in the WHILE loop, N will equal 31, so that the next IF statement will be true:

IF(N==MAGIC)

TIME, which was zero, is now set to one, as the time which was consumed by the WHILE loop and other parts of the program is one-half second. N (which is 31) is set back to one so it will count up one second.

Each time around the inner WHILE loop, the computer tests to see if you have typed an 's' or a 't' by using two CHRDY function calls. A CHRDY function call checks if you have typed any character. CHRDY is short for CHARACTER-READY. If the character that is ready (typed) is an 's', then the computer breaks out of the inner WHILE loop and comes to the statement:

IF(K=='s') [

That statement is false because K is still 'g', so it skips that and comes to the statement:

IF(K=='x') BREAK

That statement is false because K is still 'g', so the computer skips it and comes to the end of the outer WHILE loop. It goes back to the beginning of the WHILE and first comes to the statement:

K=GETCHAR

The computer gets the character 's', which was typed before, and puts it into K. Next it comes to the statement:

IF(K=='g')

This is false since K is now 's', so it skips that IF and comes to the statement:

IF(K=='s')[

This is true, so it does the commands listed between the brackets enclosing the IF statement which are to print the number of seconds on the screen.

After it finishes that it goes to the top of the outer WHILE loop and comes to the statement:

K=GETCHAR

The stopwatch has just finished one complete timing, from 'g' to 'stop.' Now it is ready to start up again.

There is one command I haven't explained yet. You can find out the number of seconds while the stopwatch is running by typing a 't.'

If the stopwatch is started up again by typing a 'g' the computer will come to the two CHRDY function calls. One of them checks if you have typed a 't.' If you have, then the computer does a GETCHAR and gets the character. Then it prints out the time; but after that the stopwatch continues counting.

If you want to stop the program, type 'x.' Eventually, the computer will come to the statement:

IF(K=='x') BREAK

This is true, so the computer will break out of the outer WHILE loop and come to the end of the program. ■

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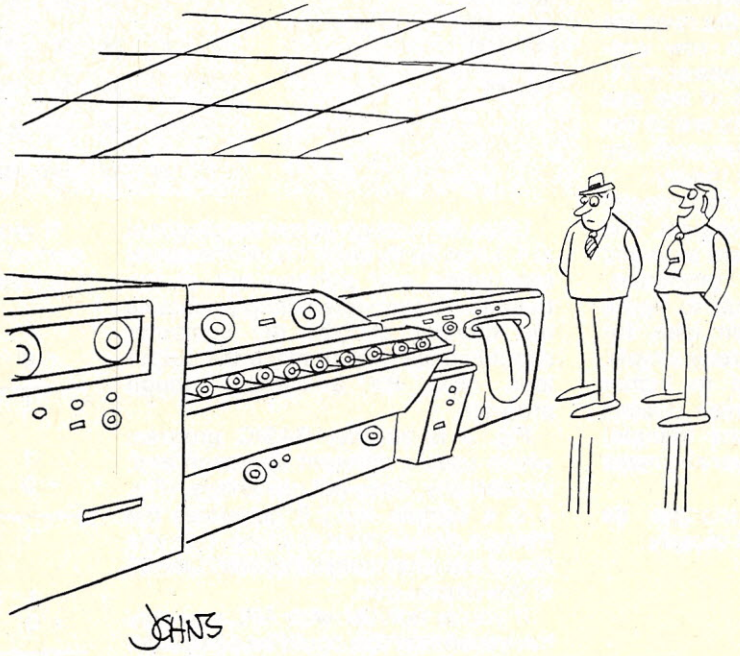

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Pascal's Triangle: What's It All About?

An APL and Basic approach to one of the oldest, and most interesting, programming problems.

Jordan Mechner

This triangle has quite a few interesting properties.

```
1
1  1
1  2  1
1  3  3  1
1  4  6  4  1
```

Each row is symmetrical. Each row also happens to contain the coefficients for a binomial expansion. The descending diagonals are the same as the columns. The sums across the ascending diagonals form the Fibonacci sequence. The sums across the rows are all powers of two. Each row corresponds to the digits of a power of 11. Every element is the sum of the one above it and the one to the left of the one above it. All the elements are identities in combinatorial theory.

This is, of course, Pascal's Triangle, a favorite programming problem. The ways it can be generated are as varied and interesting as its properties, though often more difficult to figure out. The powers-of-eleven idea, for instance, which seemed pretty simple, conks out when we get to higher powers (11^6 = 161051, which doesn't look like it belongs in the triangle) because the digits carry over and make a mess.

How else can the triangle be generated? Let's look at it closely:

```
1
1    1
1    2    1
1    3    3    1
1    4    6    4    1
```

Any element of any column can be found by adding the previous element of that column to the previous element of the previous column. Let's see if we can pack this into a BASIC program. Fig. 1 is a listing of the program and Fig. 2 is a sample run.

Fig. 1

```
LIST
10 DIM P(11,11)
20 FOR C=1 TO 11
30 P(C,C)=1
40 NEXT C
50 FOR R=1 TO 10
55 T=0
60 FOR C=1 TO R
70 P(R+1,C)=P(R,C)+P(R,C-1)
80 PRINT TAB(T);P(R,C);
85 T=T+5
90 NEXT C
100 PRINT
105 PRINT
110 NEXT R
120 END
```

Fig. 2

```
RUN
 1

 1    1

 1    2    1

 1    3    3    1

 1    4    6    4    1

 1    5    10   10   5    1

 1    6    15   20   15   6    1

 1    7    21   35   35   21   7    1

 1    8    28   56   70   56   28   8    1

 1    9    36   84   126  126  84   36   9    1

 1    10   45   120  210  252  210  120  45   10   1

 1    11   55   165  330  462  462  330  165  55   11   1
```

Lines 20 through 40 set the diagonal at 1. Lines 50 through 110 do the actual calculating and printing out of the triangle. The variable T simply contains the number of tabs the computer should space over to make the output look nice. It's a simple enough program.

Fig. 3 is another BASIC program which uses a different approach and, incidentally, does not use arrays. (Fig. 4 is a sample run.) It generates the triangle one element at a time. Can you figure out what makes this tick? Line 60 is the crucial one.

If you're familiar with APL you may have seen that this could be a beautiful demonstration of its power and conciseness. Fig. 5 is an APL version of the program. Line 1 sets X, which contains only one row at a time, at 1. Line 2 prints out X. Line 3 catenates a zero onto the end, then onto the beginning, and adds the two together. Line 4 loops back to line 2. Fig. 6 is a run of the program.

It looks like line 3 is the interesting part of the function.

Let's examine its action more closely:

```
X = 1

   1 0
 + 0 1
 -------
   1 1

X = 1 1

   1 1 0
 + 0 1 1
 -------
   1 2 1

X = 1 2 1

   1 2 1 0
 + 0 1 2 1
 ---------
   1 3 3 1

X = 1 3 3 1
```

This is a much simpler and more elegant way of looking at the adding up of elements, but it would be nearly impossible to work out in BASIC.

There are other ways to generate Pascal's Triangle (there will always be

Fig. 3

```
LIST
10 FOR N=0 TO 11
20 LET T=0
30 FOR R=0 TO N
40 LET C=1
45 IF N<N-R+1 THEN 80
50 FOR X=N TO N-R+1 STEP -1
60 LET C=C*X/(N-X+1)
70 NEXT X
80 PRINT TAB(T); C;
90 LET T=T+5
100 NEXT R
110 PRINT
120 PRINT
130 NEXT N
140 END
```

Fig. 4

```
RUN
 1

 1   1

 1   2   1

 1   3   3   1

 1   4   6   4   1

 1   5   10  10  5   1

 1   6   15  20  15  6   1

 1   7   21  35  35  21  7   1

 1   8   28  56  70  56  28  8   1

 1   9   36  84  126 126 84  36  9   1
```

```
      ∇PASCAL1[[]]∇

      ∇ PASCAL1
[1]   X←1
[2]   X
[3]   X←(X,0)+0,X
[4]   →2
      ∇

      PASCAL1

 1
 1 1
 1 2 1
 1 3 3 1
 1 4 6 4 1
```

other ways). In fact, here are a few challenges:

1 - Write a BASIC program to print out a specified row of Pascal's Triangle without wasting memory by storing all the others.

2 - Write an APL function to do the same thing. (Can you do it with eight characters?)

3 - Write programs in BASIC and APL to prove that when you sum across the rows, you get powers of two and that when you sum across the ascending diagonals, you get the Fibonacci sequence.

4 - Use the powers-of-eleven idea to generate a triangle. Find some way of catching the digits when they carry over.

■

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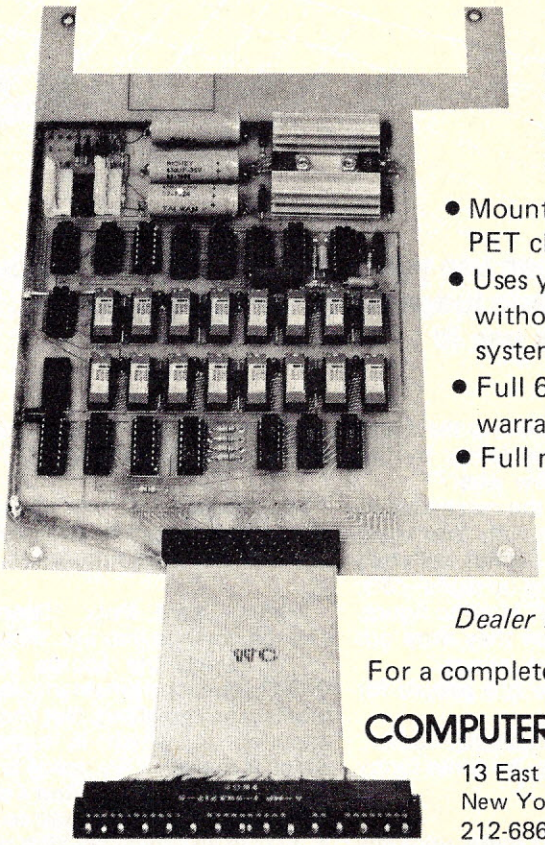

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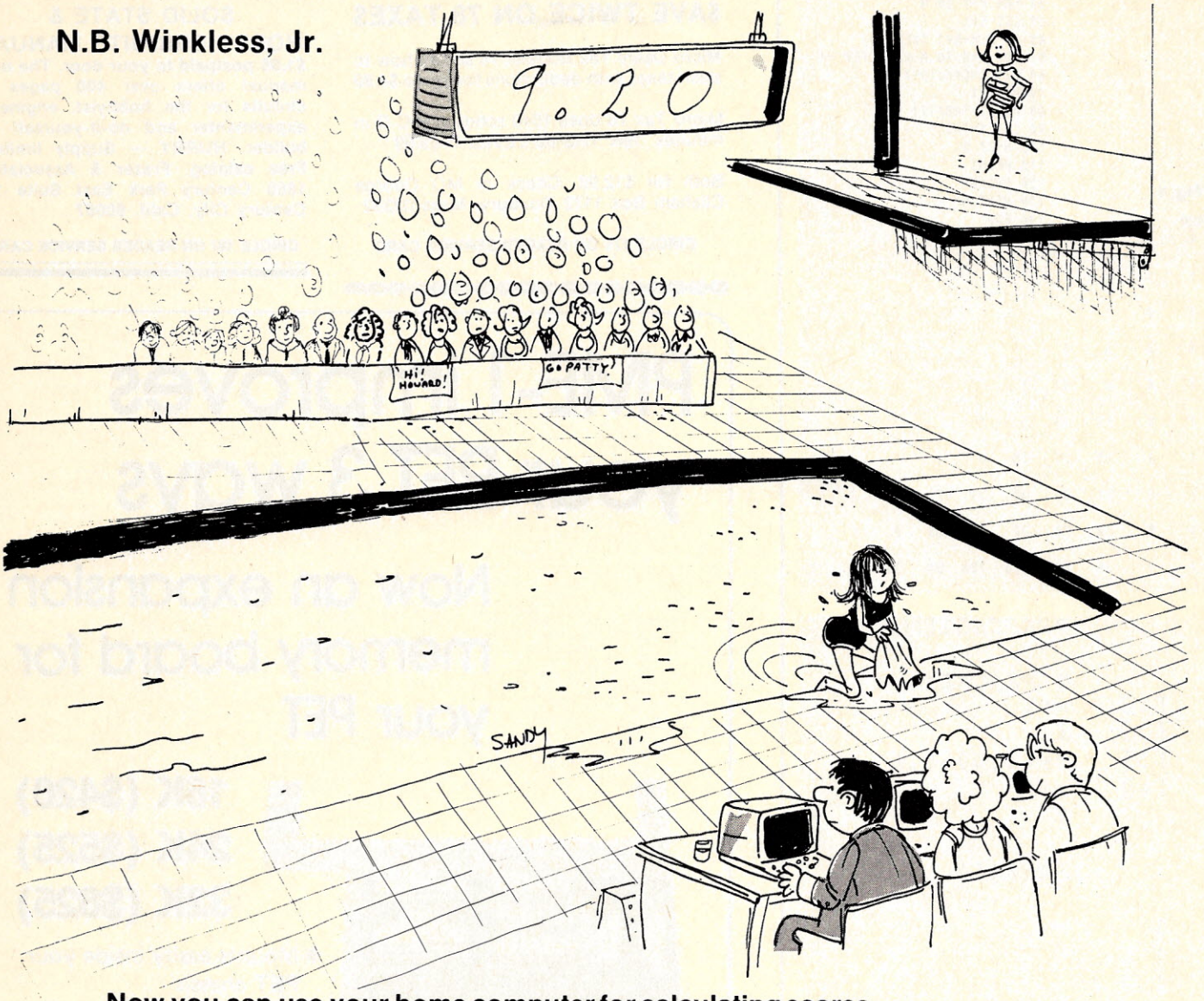

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Young Stanislaus ran into the living room and grabbed his father by the wrist. Pop sighed. "Now what?"

"Come sit down at the machine and see what I've come up with. You know how they score in the Games, with half a dozen judges holding up signs—'8½, 7½, 6½, 7, 8,'—all that? Hard to figure, right? Especially when they drop out the highest and lowest ratings."

"Unh-hunh. They've got *people* for that."

"And there's the 'difficulty factor.' They've got to multiply by some funny numbers—2.8 or 3.5..."

"So?"

"So type 'RUN' and make up some numbers."

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Pop sighed and obeyed. Here's the way it went. (See Figure 1).

Pop looked at the sheet. "Fast. What's the program look like?" Stan showed him. (See Figure 2)

"Hmm," said Pop. "Seems clear enough down to line 114. What's that?"

"I'm taking the scores as they're INPUT for each contestant, and adding them up as I go along. But I have to pay attention to which is highest, and which is lowest, if I'm going to subtract those from the totals. And I do. We've picked Option B at 50, and so A$ is not A. X(X) is an arbitrarily high number—actually 10∧3, as you see at line 3—so I try that out against each of the scores as they're reported, there at 114, and spot the lowest in the group. Same way with Y(X), the highest scores. Then I take them both out at 1500."

"Hmmm."

"At 1500, they're subtracted, as they should be. Are you following this?"

"Hmm. And what's going on in the 5000 area?"

"That's a SORT routine I made up. Y'see ... Uh, shall I explain it or would you rather figure it out for yourself?"

Pop groaned. "Never mind. How come you gave *me* the by-line?"

Stan grinned. "When I sell it, I don't want anybody to know it came from an eleven-year-old kid." ■

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CIRCLE 152 ON READER SERVICE CARD

```
RUN
ATHLETES: HOW THEY SCORE AND RANK.
(WE'LL PAUSE FOR CALCULATIONS...)

THIS PROGRAM FACILITATES SCORING
OF DIVING, GYMNASTICS, ETC.,
IN WHICH  SEVERAL JUDGES AND
SEVERAL DEGREES OF DIFFICULTY
MAY HAVE TO BE CALCULATED.

BY N. B. WINKLESS, JR., 1978

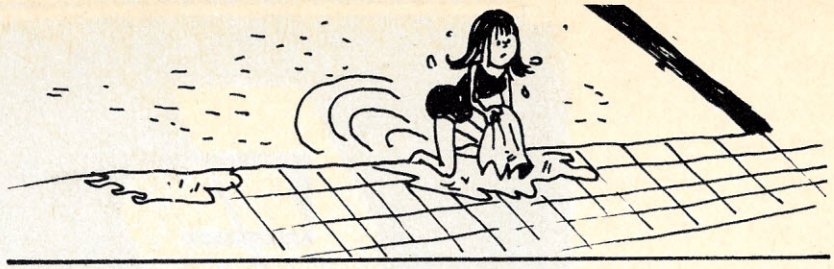
HOW MANY CONTESTANTS (LIMIT 100)? 5
HOW MANY JUDGES? 5
WHICH SCORING METHOD --
     USE ALL SCORES (A)... OR
     DROP HIGHEST & LOWEST (B)? B
OKAY, WE'LL DROP THOSE SCORES.

ENTER DIFFICULTY FACTOR FOR CONTESTANT # 1
(IF NONE, ENTER 0)? 2.3
ENTER JUDGES' SCORINGS (ALL 5  OF THEM, PLS.)--
JUDGE # 1  RATES CONTESTANT # 1  AT ? 6.5
JUDGE # 2  RATES CONTESTANT # 1  AT ? 6.0
JUDGE # 3  RATES CONTESTANT # 1  AT ? 7.0
JUDGE # 4  RATES CONTESTANT # 1  AT ? 6.0
JUDGE # 5  RATES CONTESTANT # 1  AT ? 5.5
OKAY, NEXT CONTESTANT --
ENTER DIFFICULTY FACTOR FOR CONTESTANT # 2
(IF NONE, ENTER 0)? 3.1
ENTER JUDGES' SCORINGS (ALL 5  OF THEM, PLS.)--
JUDGE # 1  RATES CONTESTANT # 2  AT ? 6.0
JUDGE # 2  RATES CONTESTANT # 2  AT ? 5.5
JUDGE # 3  RATES CONTESTANT # 2  AT ? 7.0
JUDGE # 4  RATES CONTESTANT # 2  AT ? 5.5
JUDGE # 5  RATES CONTESTANT # 2  AT ? 5.0
OKAY, NEXT CONTESTANT --
ENTER DIFFICULTY FACTOR FOR CONTESTANT # 3
(IF NONE, ENTER 0)? 1.8
ENTER JUDGES' SCORINGS (ALL 5  OF THEM, PLS.)--
JUDGE # 1  RATES CONTESTANT # 3  AT ? 8.0
JUDGE # 2  RATES CONTESTANT # 3  AT ? 7.5
JUDGE # 3  RATES CONTESTANT # 3  AT ? 9.5
JUDGE # 4  RATES CONTESTANT # 3  AT ? 8.5
JUDGE # 5  RATES CONTESTANT # 3  AT ? 7.5
OKAY, NEXT CONTESTANT --
ENTER DIFFICULTY FACTOR FOR CONTESTANT # 4
(IF NONE, ENTER 0)? 4.2
ENTER JUDGES' SCORINGS (ALL 5  OF THEM, PLS.)--
JUDGE # 1  RATES CONTESTANT # 4  AT ? 5.3
JUDGE # 2  RATES CONTESTANT # 4  AT ? 3.5
JUDGE # 3  RATES CONTESTANT # 4  AT ? 5.0
JUDGE # 4  RATES CONTESTANT # 4  AT ? 6.0
JUDGE # 5  RATES CONTESTANT # 4  AT ? 4.0
OKAY, NEXT CONTESTANT --
ENTER DIFFICULTY FACTOR FOR CONTESTANT # 5
(IF NONE, ENTER 0)? 3.6
ENTER JUDGES' SCORINGS (ALL 5  OF THEM, PLS.)--
JUDGE # 1  RATES CONTESTANT # 5  AT ? 7.5
JUDGE # 2  RATES CONTESTANT # 5  AT ? 7.0
JUDGE # 3  RATES CONTESTANT # 5  AT ? 6.5
JUDGE # 4  RATES CONTESTANT # 5  AT ? 7.0
JUDGE # 5  RATES CONTESTANT # 5  AT ? 5.5

THAT'S IT.
JUST A SECOND.  I'M THINKING...
C( 1 )- 42.55
C( 2 )- 52.7
C( 3 )- 43.2
C( 4 )- 60.06
C( 5 )- 73.8
# 5  CONTESTANT RANKS 1  AT 73.8  POINTS.
# 4  CONTESTANT RANKS 2  AT 60.06  POINTS.
# 2  CONTESTANT RANKS 3  AT 52.7  POINTS.
# 3  CONTESTANT RANKS 4  AT 43.2  POINTS.
# 1  CONTESTANT RANKS 5  AT 42.55  POINTS.

THAT COVERS OUR  5  CONTESTANTS
```

FIGURE 1



```
1 PRINT "ATHLETES: HOW THEY SCORE AND RANK."
2 PRINT "(WE'LL PAUSE FOR CALCULATIONS...)"
3 DIM X(100):FOR O=1 TO 100:X(O)=10^3:NEXT O
4 DIM C(100),D(100),H(100),R(100),Y(100),Z(100)
6 PRINT
9 DIM T(100)
10 PRINT "THIS PROGRAM FACILITATES SCORING"
12 PRINT "OF DIVING, GYMNASTICS, ETC.,"
14 PRINT "IN WHICH  SEVERAL JUDGES AND"
16 PRINT "SEVERAL DEGREES OF DIFFICULTY"
18 PRINT "MAY HAVE TO BE CALCULATED."
20 PRINT: PRINT "BY N. B. WINKLESS, JR., 1978"
25 PRINT
26 INPUT "HOW MANY CONTESTANTS (LIMIT 100)";C
27 INPUT "HOW MANY JUDGES";J
30 PRINT "WHICH SCORING METHOD --"
40 PRINT "     USE ALL SCORES (A)... OR"
50 INPUT "     DROP HIGHEST & LOWEST (B)";A$
55 IF A$="B" THEN PRINT "OKAY, WE'LL DROP THOSE SCORES.": PRINT: GOTO 80
70 PRINT "OKAY.  WE'LL COUNT ALL SCORES."
75 PRINT
80 X=X+1: PRINT"ENTER DIFFICULTY FACTOR FOR CONTESTANT #";X
82 INPUT "(IF NONE, ENTER 0)";D(X)
83 IF D(X)=0 THEN D(X)=1
84 PRINT "ENTER JUDGES' SCORINGS (ALL";J;" OF THEM, PLS.)--"
100 U=U+1
104 PRINT "JUDGE #";U;" RATES CONTESTANT #";X;" AT ";
105 INPUT C(X)
112 T(X)=T(X)+C(X)
114 IF X(X)>=C(X) THEN X(X)=C(X)
116 IF Y(X)<=C(X) THEN Y(X)=C(X)
118 IF U=J THEN C1=C1+1: GOSUB 1500
119 IF C1=C THEN 200
120 IF U=0 THEN PRINT "OKAY, NEXT CONTESTANT --": GOTO 80
125 GOTO 100
200 !REM -- GOING TO A FINISH
220 FOR V1=1 TO C
230 C(V1)=T(V1)
240 NEXT V1
300 GOTO 4800
400 PRINT "THAT'S IT.": PRINT
1500 IF A$<>"A" THEN T(X)=T(X)-(X(X)+Y(X))
1510 T(X)=T(X)*D(X)
1515 U=0
1516 PRINT
1520 RETURN
4800 PRINT: PRINT "THAT'S IT.": PRINT
4810 FOR K=1 TO 50
4820 NEXT K
4828 PRINT "JUST A SECOND.  I'M THINKING..."
4830 FOR K=1 TO 100: NEXT K
4900 PRINT
4901 FOR M5=1 TO X
4902 PRINT "C(";M5;")-";C(M5)
4903 NEXT M5
5000 Q=Q+1
5100 FOR Z=Q TO X
5105 A=C(Q)
5110 IF A<=C(Z+1) THEN A=C(Z+1): Q=Z+1
5115 IF Z+1=X THEN 5130
5120 NEXT Z
5130 T=T+1
5140 PRINT "#";Q;" CONTESTANT RANKS";T;" AT";C(Q);" POINTS."
5150 IF T=X THEN 5300
5160 FOR J=1 TO X
5170 C(Q)=0
5180 NEXT J
5190 Q=0: GOTO 5000
5300 PRINT: PRINT "THAT COVERS OUR ";X;" CONTESTANTS"
5310 PRINT: PRINT: END
```

FIGURE 2

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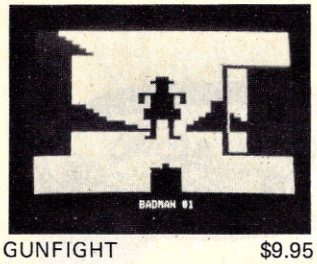

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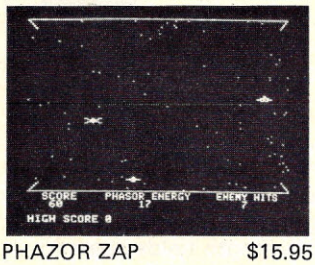

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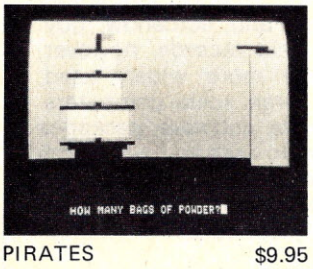

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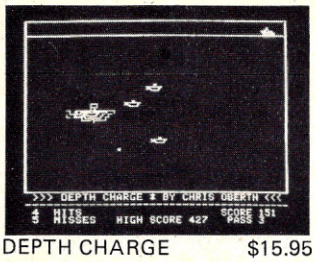

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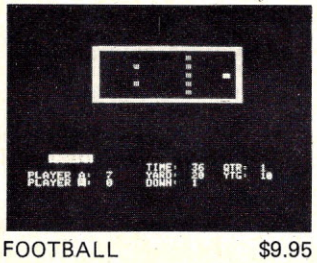

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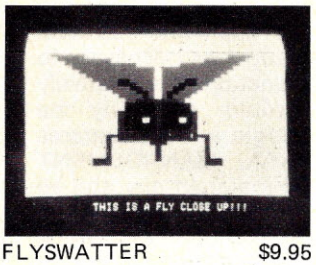

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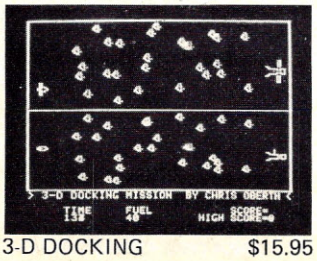

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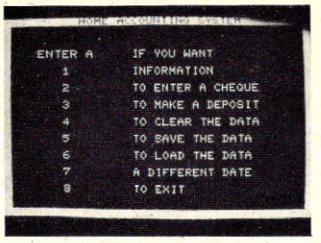

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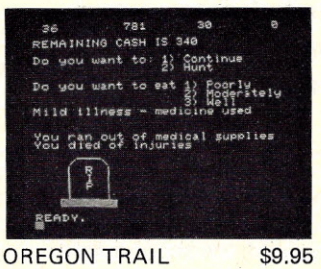

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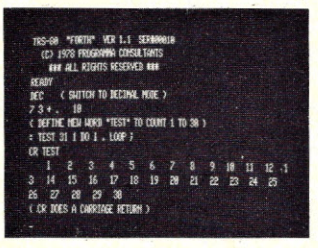

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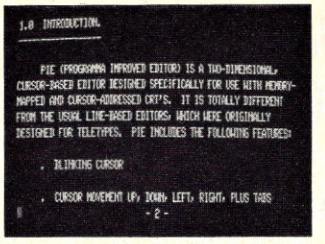

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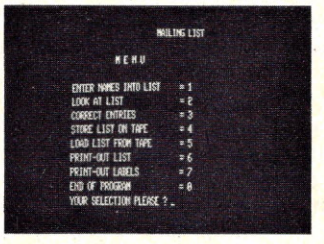

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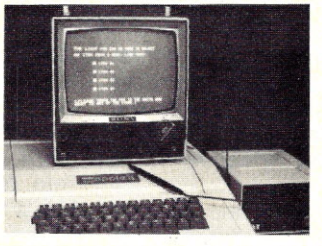

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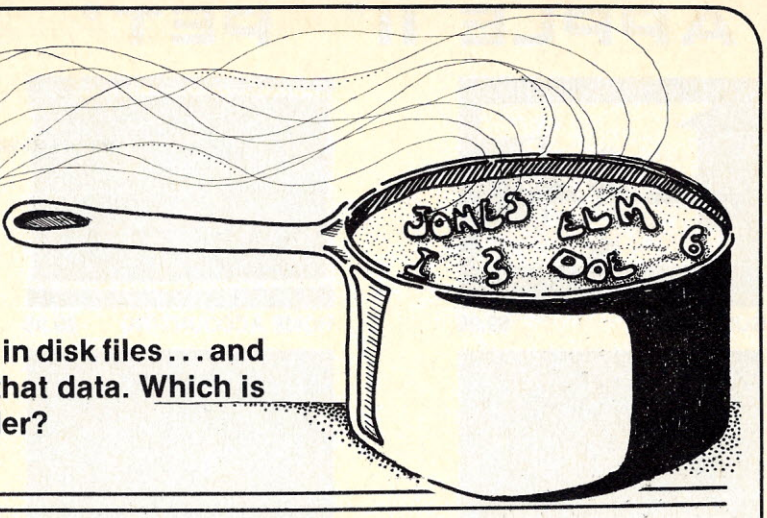
What Are Data?
Data files explained

Helmar B. Herman



There are several methods for storing data in disk files . . . and there are several methods for accessing that data. Which is best and what are the tradeoffs to consider?

What Are Data?

A file is a named collection of related records. A record is a collection of related data items (fields) grouped into a single unit (the record). Figure 1 shows a simple name & address file as an example.

A name & address file would contain an entry (record) for each person. Each record would contain a particular person's name, address, city, state and zip code. These data items are known as fields. Thus the name & address file consists of 5 fields. That is, each record of the file contains 5 fields.

In order to process the records there must be some way of determining when one field stops and the next field begins. It may be quite obvious to YOU that in the first record the name field contains "John Jones" and the address field contains "123 Elm Street" but unless some special technique is used, a computer program would just see the entire record as one big field. There must, then, be some standard technique for separating fields with a record.

There are, in fact, two techniques generally used to identify fields within a record. One is called "variable length fields" and the other is called "fixed length fields."

When variable length field records are used, all fields are adjoining and are separated by a special character called the delimiter character (see Fig. 2). The specific delimiter character varies from system to system. Each field is variable in length depending on the data content. For example, the name field of record 1 is 10 characters in length while the name field of record 2 is 16 characters long (not counting the delimiter character—in this case a semi-colon).

Notice that in record 1, the address field starts in position 12 of the record while in record 2, the address field starts in position 18. Not only are the fields variable in length but, except for the first field, they also are variable in position. The sequence of the fields, however, is fixed. That is the first field is always the name field, the second field is always the address, and so on.

Fixed length field records (see Fig. 3) are quite different. Each field occupies a specific portion of the record. The name field occupies positions 1-20, the address field 21-40, the city field 41-50, the state field 51-52 and the zip code field 53-57. No matter which record is read, the city field will always be in positions 41-50. If the data in a field is shorter than the maximum allowed for that field, then the data must be padded with blanks at the end of the data so that the next field will start in the proper location. Numeric fields are sometimes padded on the left with zeros. For example, the name field of record 1 contains "John Jones" followed by 10 blanks. If it weren't for the extra blanks, the next field (the address) would be in the wrong location. One important characteristic of fixed length field records is that the length of the data in each field can never exceed the length of that field. As seen in Fig. 3, no name greater than 20 characters can ever be entered.

When designing a variable length field file, you must determine each field's name and the order of the fields. Also, you must decide on a delimiter character. You must be careful to pick a character that will never appear as data in a field.

For fixed length field files, in addition to each field's name and order, you must also decide on the size of each field. Once the size of a field has been selected, it can only be changed with great difficulty. Be sure that each field is large enough to contain the longest data item you will ever need in that field. In the case of numeric fields, for example, if you have chosen a field length of 7, then the field can never hold a dollar amount greater than 9999.99 or less than -999.99.

Figure 4 lists the various trade-offs between variable length field records and fixed length field records. On the surface, variable length fields seem to have the most benefits. Everything seems compact and, somehow, tidy. Fixed length field records, however, are by far the more widely used, especially in large scale computers. General purpose software packages are much easier to write for fixed length field files. Also, the problem of selecting a suitable delimiter character is sometimes very difficult.

How Do You Manage It?

The effective management of data files is one of the first considerations to be made when designing any new software system. No matter what the application, it must be possible to add, update and delete records from the data file(s). Various reports will be necessary. It must be possible to sort the file into various sequences for the reports. A method for backing up the files is also needed. When adding or updating records, it would be very inefficient to have the operator enter the entire record as it appears on disk (pad characters and all). Instead, the update program must allow individual fields to be updated and, when adding records, must prompt the operator for each field.

Since all of the above functions are required for any application written, and since the programs necessary to perform these functions are relatively complex, it would obviously be desirable if a single set of programs (called a DATA MANAGEMENT SYSTEM) could maintain any and all data files.

That then is the function of a DATA MANAGEMENT SYSTEM. A set of programs, general in nature, that are able to maintain any data file.

There are three methods of organizing and maintaining data files. Sequential, direct and indexed sequential.

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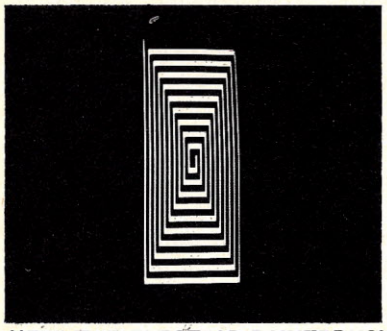

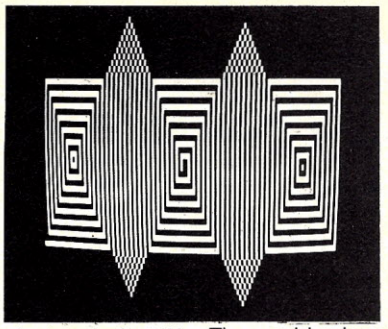

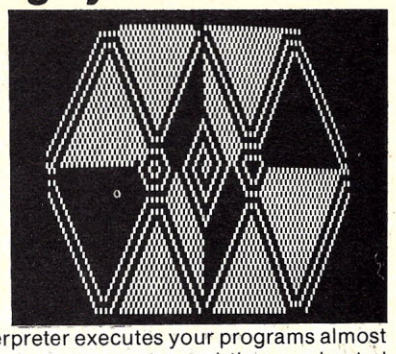

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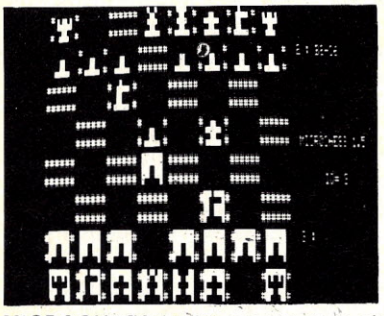

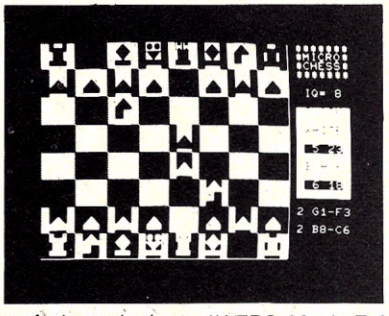

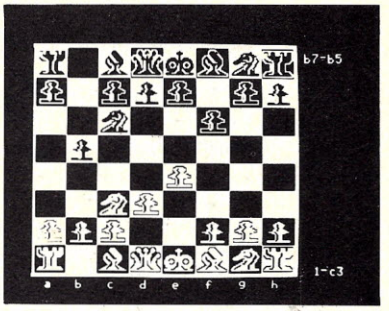

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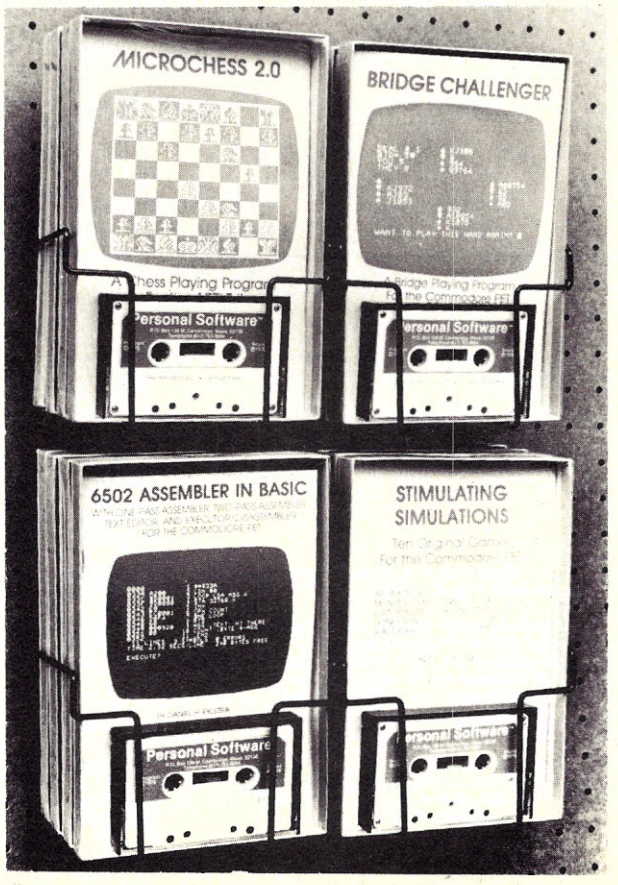

Figure 1 - Name & Address file - no technique

```
Record     .......................C O N T E N T S.......................
                  1111111111222222222233333333334444444444555555555556
           12345678901234567890123456789012345678901234567890123456789 0
           :         :         :         :         :         :         :
   1       John Jones 123 Elm Street Austin TX 93214
           :         :         :         :         :         :         :
   2       Bill Smithington 87 Farmer Avenue Tustin CA 93217
           :         :         :         :         :         :         :
   3       Arnold Fram 615 Green Road Pasadena CA 96250
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   n       Robert Kane 605 6th Street Chicago IL 04932
           :         :         :         :         :         :         :
```

Figure 2 - Name & Address file - variable length fields

```
Record     .......................C O N T E N T S.......................
                  1111111111222222222233333333334444444444555555555556
           12345678901234567890123456789012345678901234567890123456789 0
           :         :         :         :         :         :         :
   1       John Jones;123 Elm Street;Austin;TX;93214;
           :         :         :         :         :         :         :
   2       Bill Smithington;87 Farmer Avenue;Tustin;CA;93217;
           :         :         :         :         :         :         :
   3       Arnold Fram;615 Green Road;Pasadena;CA;96250;
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   n       Robert Kane;605 6th Street;Chicago;IL;04932;
           :         :         :         :         :         :         :
```

Figure 3 - Name & Address file - fixed length fields

```
Record     .......................C O N T E N T S.......................
                  1111111111222222222233333333334444444444555555555556
           12345678901234567890123456789012345678901234567890123456789 0
           :         :         :         :         :         :         :
   1       John Jones          123 Elm Street      Austin    TX93214
           :         :         :         :         :         :         :
   2       Bill Smithington    87 Farmer Avenue    Tustin    CA93217
           :         :         :         :         :         :         :
   3       Arnold Fram         615 Green Road      Pasadena  CA96250
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   .       :         :         :         :         :         :         :
   n       Robert Kane         605 6th Street      Chicago   IL04932
           :         :         :         :         :         :         :
```

Figure 4 - Variable/Fixed field tradeoffs

Variable	Fixed
No field may contain the delimiter character.	Since there are no delimiter characters a field may contain any ASCII character.
Maximum field lengths are easier to change (usually nothing has to be done unless the program is expecting a particular maximum field length.)	Field lengths can only be changed with great effort. The major problem is that if a field length is changed the location of all fields following that field are also changed. Not only will program changes be required but the data file itself will have to be re-structured to the new format.
Very few software packages support variable length fields.	Most software packages support fixed length fields.
Variable length fields usually consume more CPU time because each field must be scanned for. This time may be offset somewhat by the fact that variable length records are usually shorter than fixed length records and therefore the I/O time will be less.	Since each field location is fixed, no scanning is necessary.
Blocking of records (placing more than one record in a sector) is very difficult. Direct access with blocked variable length records is virtually impossible.	Blocking of records is relatively simple. If the sector size is 250 and each record is 50 bytes long then there will be a record at position 1, 51, 101, 151, and 201 of each sector.

Maintaining a sequential (SAM) file always requires copying the file to another place on disk and updating it as you go. Or, if the file will fit in main storage, the file can be read into main storage, updated and then written back to disk. The latter technique, however, does not allow for much expansion of the file. When the first technique is used, then the updates must be in the same order as the data file. If, for example, record 5 has been updated and written out to disk, it is too late to go back and update record 3.

A common method for updating sequential files is to enter all the updates into an update file, sort the update file into the same sequence as the main data file, and run the update program which reads the update and data files and outputs the new data file and an error report. The sorting insures that the updates are in the proper sequence. Of course, the update program must check for such things as updates or deletes to non-existent records, out of sequence updates (don't assume anything, especially that the updates are in the proper sequence), syntax errors and more.

Generally speaking, sequential files are rarely used or supported by data management systems. The other two methods are much preferred.

Direct files (DAM) are maintained as follows. Added records are always appended to the end of the file. To identify a record to be updated or deleted its relative record number is used. The relative record number is simply the record number within the file. The first record in the file is record 1, the second is record 2, etc. Since the access is directly to the desired record, this is the fastest method of all. When a record is deleted, it is not actually deleted at this time. To do so would require that all of the records past the deleted record be shifted one record to the front of the file. Not only would this be too time consuming but also all of the record numbers past the deleted record would change. Instead of physically deleting the record, it is flagged for deletion. A special, predetermined portion of the record is set to indicate that this is a deleted record. All other programs of the data management system must look for and recognize that delete flag. At some time in the future, a special program is run that "compacts" the file, removing all deleted records and shifting all the remaining records down toward the beginning of the file. It should be noted that until the file is compacted, the delected records are still there and the data management system should allow the record to be reclaimed.

There are two main disadvantages to direct files. The first is that the records are not maintained in any particular sequence. Added records are always placed at the end. If a report is printed

from a direct file, specific records may be difficult to find. The second disadvantage is actually related to the first. In order to update a record, you must know its record number. This requires looking up the record number from some hard copy report (unless the data management system has a scan facility). Both of these disadvantages are eliminated through the use of sorting. After a file has been updated, it can then be resorted into the desired sequence before printing the report. As a result records and record numbers can be found easily and quickly.

Indexed sequential (ISAM) files add a powerful level of sophistication to a data management system—at a significant cost.

Basically, an ISAM file consists of a direct access data file, an index file and an overflow file.

The data file looks much the same as a regular direct access file. The main difference is in the addition of an index file.

When a file is defined, a portion of the record is designated as the 'KEY'. In a typical name and address file, for example, the key would be the name. The data file is maintained in key sequence. That is, 'ABLE' comes before 'BAKER' which comes before 'BONNET', and so on. The index file consists of the highest key contained on each track in the file (a track typically contains 10 or 16 sectors/records). When a particular record is desired, only the index file need be searched in order to find the track upon which the desired record resides. Then the track is searched to find the desired record. Sometimes, if there is enough main storage, the index file (or a portion of it) is kept in main storage, thus speeding things up even more.

The overflow file is used when records are added. If a track is full, and a new record is added that would normally go on that track, then the last record of the track is shifted off the track to make room for the new record. The record shifted off is then rewritten to the overflow file.

Although undeniably powerful, ISAM files are very complex and the programs to maintain them are much larger than those required to maintain the other two file types. As an example of the relative program sizes, a DAM logic module for an IBM/370 requires about 4K of main storage while VSAM (a much advanced version of ISAM) requires over 300K. Also ISAM files sometimes have a very disturbing way of self-destructing, especially if a program is interrupted while maintaining a file.

Given a satisfactory sorting program and report generator, a direct access data management system can easily compete with an ISAM system. ■

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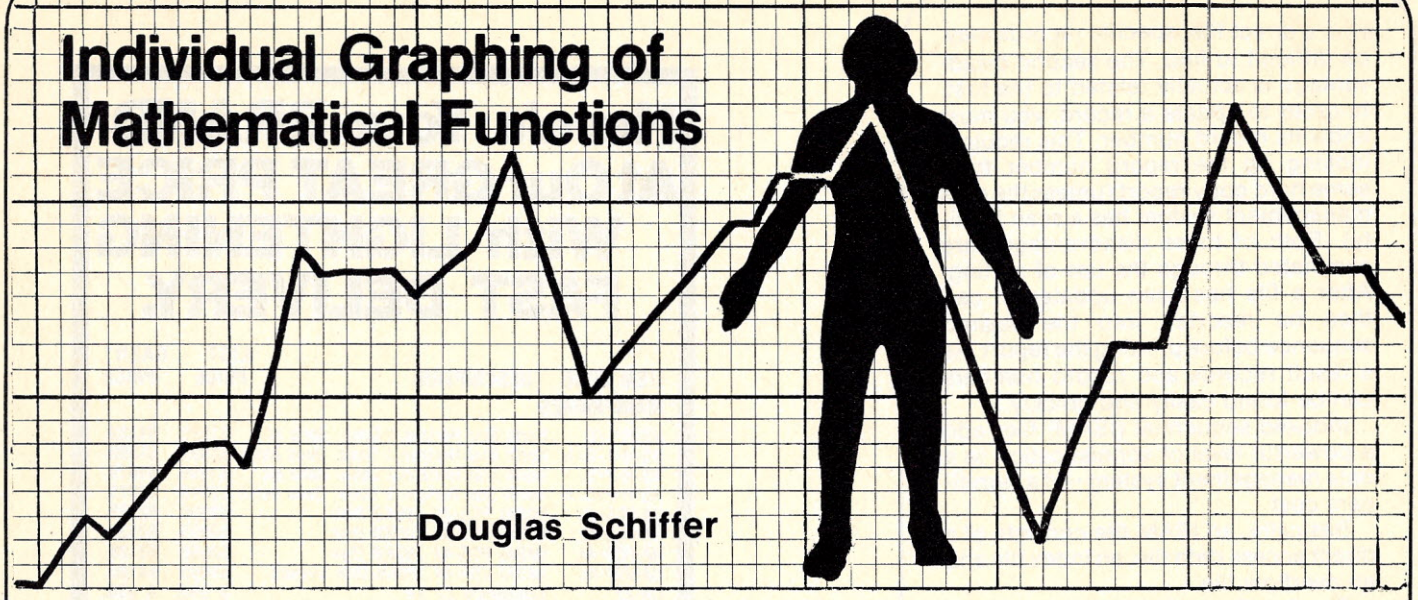

Douglas Schiffer

Self-modifying programming is an interesting concept when used intelligently and creatively. However, it must be used with extra caution, because self-modifying programs can be difficult to debug, and can also have dire results when used incorrectly (namely, destroying your program and BASIC itself). Also, self-modifying code should not be used as an alternative to well-structured programs.

A problem that frequently appears in mathematics courses is the individual graphing of a handful of different mathematical functions. (y = sin(x), y = log(4.2*x), y = 2*x+3 etc.). One way to have the computer do this is to write a program that has as many DEF statements as you have functions. You then have a separate graphing loop for each graph. The program would look something like this:

```
10 DEF FNA(x) = SIN(x)
20 DEF FNB(x) = LOG(4.2*x)
30 DEF FNC(x) =
    .
    .
    .
500 FOR I = A TO B STEP C
510 Y = FNA(I)
520 GOSUB 1000 ! GRAPHING SUBROUTINE
530 NEXT I
    .
    .
600 FOR I = A TO B STEP C
610 Y = FNB(I)
620 GOSUB 1000
630 NEXT I
```

The resulting program is very large and not at all elegant especially if you have a large number of functions. Of course you can write a program with only one "DEF" statement and let the user of the program change the function after every run. The problem here is that students with no previous computing experience have trouble logging on the system, calling up the program and operating the programs in general. It is also extremely hard for them to modify the programs. Furthermore, it is very distracting and time consuming to keep starting and stopping the program.

The solution we found uses a variation on the second technique. There is only one DEF statement but the computer rewrites the function definition by itself; the program literally rewrites itself. Two versions are provided.One is for a compiler (Digital PDP11/40 BASIC). The other is designed for an interpreter (Mits 12K BASIC).

The two versions go about this 'self-modification' in two different ways. For the compiler version control is transferred to a special editor-like program (SETUP) via the CHAIN instruction. SETUP then reads the source code version of TABFUN into a string matrix (each line of TABFUN is one element of the string matrix). The user is then asked what function he/she would like to graph. (One types 'SIN(X*PI)+3' if that is the function he/she wants.) SETUP then combines the element of a DEF statement (line#, "DEF FNA(X)=" and the user supplied string) to make a legal BASIC statement. This string replaces the element of the string matrix that contained the old function definition. At this point the old TABFUN on the disk is erased and the string matrix is written onto the disk in its place. Control returns to TABFUN via the CHAIN command.

The same technique could have been used in TABFN1, the interpreter diversion. But since most smaller microcomputers don't have a disk based language with the CHAIN command, an alternative approach is in order. Here the program searches the core memory for a 'D' followed by an 'E' followed by 'F' . . . When it finds this spot it stops and asks for a new function like the compiler version. The new string is then POKE'd into successive locations following the '=' sign. A carriage return plus an END statement are added for proper execution. Control then returns to the main graphing and tabulating routines.

Of course, aspects of a program other than mathematics functions could be modified in the same way. Definitions, string functions, DIM statements, setting of constants, or even program logic could also be changed with equal ease. The replace statements could come from the user or a special data file.

A final comment on self-modifying programs: BE CAREFUL. Ordinary programs, when they 'bomb,' just produce extraneous outputs. Self-modifying programs can do that and/or wipe themselves out (for example, the program is the same after the run, only minus a mere 57 lines). It's a good idea to save the program on paper tape, cassette, or somewhere safe on the disk before you run it on experimental or first time basis. ■

LISTING OF "TABFUN. BAS"

```
10 INPUT"X RANGE AND # OF SUBDIVISIONS";A,B,N
20 IF A=0 AND B=0 THEN 100
30 &"X","Y"
40 FOR X=A TO B STEP (B-A)/N
50 &X,FNA(X)
60 NEXT X
70 INPUT"DO YOU WANT TO CHANGE X RANGE";A$
80 IF A$="YES" OR A$="Y" THEN 10
90 INPUT "DO YOU WANT A GRAPH OF FUNCTION";B$
100 IF B$="N" OR B$="NO" THEN 330
110 INPUT"X RANGE AND # OF SUBDIVISIONS";A1,B1,N1
120 INPUT"Y RANGE AND # OF SUBDIVISIONS";Y1,Y2,N2
130 IF A1<>0 OR B1<>0 THEN A=A1:B=B1
140 IF N1<>0 THEN N=N1
150 IF Y1<>0 OR Y2<>0 THEN 220
160 Y1=1E38:Y2=-1E38
170 FOR X=A TO B STEP (B-A)/N
180 IF FNA(X)>Y2 THEN Y2=FNA(X)
190 IF FNA(X)<Y1 THEN Y1=FNA(X)
200 NEXT X
210 IF N2=0 THEN N2=70
220 &'GRAPH OF FUNCTION      X='A'TO'B',INCREMENT:';(B-A)/N
230 &TAB(22);'Y='Y1'TO'Y2',INCREMENT:';(Y2-Y1)/N
240 FOR X=A TO B STEP (B-A)/N
250 Y=FNA(X)-Y1
260 P=INT(Y/(Y2-Y1)*N2+.5)
270 &CHR$(10);
280 IF POS(0)>P THEN &CHR$(8); :GOTO 280
290 IF POS(0)<P THEN &TAB(P);
300 &'*';
310 NEXT X
320 &
330 INPUT"DO YOU WANT TO CHANGE FUNCTION";C$
340 IF C$='Y' OR C$='YES'THEN CHAIN'SETUP'
350 INPUT'DO YOU WANT TO RUN AGAIN';D$
360 IF D$='G' OR D$='GRAPH' THEN 110
370 IF D$='F' OR D$='FC' THEN CHAIN'SETUP'
380 IF D$='Y' OR D$='YES' THEN 10
390 DEF FNA(X)=LOG(X)
400 END
```

LISTING OF "SETUP . BAS"

```
10 ! SETUP - PUTS FNA IN "TABFUN"   D. SCHIFFER 10/77
20 OPEN"TABFUN.BAS" AS FILE 1
30 DIM A$(40)
40 INPUT LINE #1,A$(I) FOR I=1 TO 40
50 INPUT "FNA(X)=";F$
60 KILL"TABFUN.BAS":OPEN"TABFUN.BAS"AS FILE 1
70 A$(39)="390 DEF FNA(X)="+F$+CHR$(13)+CHR$(10)
80 &#1,A$(I); FOR I=1 TO 40
90 CLOSE 1
100 &"-"; FOR I=1TO 40
110 CHAIN"TABFUN.BAS"
120 END
```

LISTING OF "TABFNI . MIT"

```
10 REM VARIABLE FUNCTION GRAPHING FOR MITS 12 K BASIC
20 INPUT"X RANGE AND # OF SUBDIVISIONS";A,B,N
30 INPUT"Y RANGE AND # OF SUBDIVISIONS";C,D,N1
35 IF N1=0 THEN N1=70
40 IF C<>0 OR D<>0 THEN 100
50 C=1E37:D=-1E37
60 FOR X=A TO B STEP (B-A)/N
70 IF FNA(X)>D THEN D=FNA(X)
80 IF FNA(X)<C THEN C=FNA(X)
90 NEXT X
100 &"GRAPH OF FUNCTION X=";A;"TO";B;"STEP";(B-A)/N
110 &TAB(19);"Y=";C;"TO";D;"STEP";(D-C)/N1
120 FOR X=A TO B STEP (B-A)/N
130 P=INT((FNA(X)-C)/(D-C)*N1+.5)
140 &TAB(P);"*"
150 NEXT X
160 &"WANT TO CHANGE FUNCTION";A$
170 IF A$="NO" OR A$="N" THEN 360
180 REM NOW FOR FUNCTION CHANGE
190 FOR II=0 TO 12287
200 IF PEEK(II)<>68 THEN 300
210 FOR KK=1 TO 6
220 READ JJ
230 DATA 69,70,32,70,78,65
240 IF JJ<>PEEK(II+JJ) THEN RESTORE:GOTO 300
250 NEXT KK
260 GOTO 320
300 NEXT II
310 &"ERROR":STOP
320 INPUT"FNA(X)=";F$
325 F$=F$+CHR$(10)+CHR$(13)+"999 END"+CHR$(10)+CHR$(13)
330 FOR LL=1 TO LEN(F$)
340 POKE II+JJ+LL+10,ASC(MID$(F$,LL,1))
350 NEXT LL
360 INPUT"RUN AGAIN";B$
370 IF B$="YES" OR B$="Y" THEN 10
380 DEF FNA(X)=SIN(X)
```


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Disk Power: How to Use It
Apple's new disk system

Carl Swenson

Using Apple's new disk system, and others, will be a lot easier if you have an understanding of reading and writing files. The techniques presented below should be helpful ... especially for Apple owners.

Carl Swenson, Seattle University, Seattle, WA 98112

Photo by Carolyn Kozo

A disk for your computer is enough to make your head spin. The luxury of loading and saving programs instead of fighting a cantankerous cassette player is next to heaven, and the real power of computing is now available through the disk.

A disk enables you to write and use programs which have large amounts of stored information; for example, mailing lists, business records, nutritional values of foods and inventories. These programs require disk file reading and writing from within a program. This article gives examples, hints and warnings on use of the disk commands for data file creation and maintenance. Unfortunately, disk file commands vary greatly from BASIC to BASIC. We're going to be discussing the format and techniques for the APPLE II DISK II.

The Data File

Since most of us speak BASIC, this new concept, data file manipulation, might best be thought of as an extension of the READ — DATA operation. A data file can be thought of as a huge data statement which can be read from or written to by the program. However, it doesn't need to be stored as part of the program in RAM like a DATA statement. The data file stays out on the disk and the disk becomes a secondary, slower than RAM, memory. Presto, you have a 100K machine; and with a quick change of a disk, you get a new 100K.

In BASIC, variables of the READ list are read in sequence from the DATA list. Each successive variable takes the next piece of data. Similarly, a disk file is first OPENed, which starts any read or write at the first piece of data in the file. When finished with a file it is always CLOSED. Each time the file is opened, the result is like a RESTORE in the DATA statement; data starts fresh from the first entry.

Sequential Files

The method of starting at the beginning of a file and reading and writing in order is called sequential processing. In many situations, sequential processing is adequate and desirable. For example, programs are stored sequentially. One need only know where the file begins and ends and there is no need to know where a given line is stored. There is little muss or fuss where each line of the program or piece of data is stored because it is in order.

An example of the use of a sequential data file would be to store transactions for a personal finances program. Each transaction might require six entries:

1) transaction number,
2) date,
3) vendor code,
4) check number if a bill is paid, or date due if a bill is received,
5) account affected,
6) amount of transaction.

The transactions would be stored one after the other. When the end of the month arrives and it is time to produce the balance sheet, the transactions are read back sequentially one at a time and processed. This type of file needs controls to signal the end of the file, as well as insure that a new transaction is written after the last transaction and

not over any previous transactions. A suitable way to accomplish this is to store the transaction number (with, say, exactly 3 digits) of the last transaction of the file as the first entry of the file. This first number can be read and then an IF-THEN statement can check each subsequent transaction to see if it is the last one. Reaching the last transaction signals the end of processing, or if you are entering transactions it signals that it is in the correct position to write the next new transaction. The use of a transaction number that does not change in length (here, exactly 3 digits) is necessary in some machines (like APPLE) because of the file structure. This will be a later topic.

Direct Access Files

The solution to the limitations of sequential file manipulation is to use direct accessing (sometimes called random access). As a practical example, suppose you have a mailing list with over 2,000 names and addresses and Cher keeps sending in address changes (or name changes). You don't want to use sequential files since this could mean the entire list would need to be read and rewritten to the disk. Sequential processing does not lend itself to single actions or simple changes.

If you knew where Cher's address is stored in memory, then no read is required, and you could write over her old address with a single write and be done. The question is: At what byte is her name and address? The answer is: In the beginning there was organization (Thank God!). You decide that each name, address and city/state/zip will be 30 characters long. Thus the three lines of 30 characters will take up 93 characters (90 characters plus 3 separators). Each new name is started on a 93 byte boundary. Now if you know Cher is 20th on the list, her name will start at 20 * 89 + 1 = 1801. Notice that you do pay a price for direct access; you waste space, since few names or addresses take up all 30 characters.

In many cases there is a combination of the two methods. For example, a file might be a set of financial accounts, and each financial account might be a record having its name, the twelve monthly balances and the year to date accumulation. Thus each account will be a record ready to be accessed directly, while inside the record the balances will be stored sequentially.

Now it's time for the real thing. What follows are examples using the Apple II Disk II.

DISK II Command Subroutines

The Disk II documentation for the READ and WRITE operations leaves many questions unanswered. There are no complete examples, and if you have seen or used other BASIC file commands you realize that APPLE'S are somewhat different.

In order to avoid the recognition of several new reserved words, APPLE'S disk commands have been put in a print statement that starts with a "CONTROL-D." This can make the disk commands sometimes cumbersome and hard to read. Program 1 in integer BASIC shows how subroutines can make a READ or WRITE to the disk more readable. Notice that line 10-70 can be the first part of any of your integer BASIC programs that include READ and WRITE to files. The subroutines 20-50 are placed first to speed up the program.

A write to a file requires four things to be done:

1) GOSUB OPEN. The file must be opened. This means the file name is assigned a buffer area in RAM and the file pointer is set to the first piece of data in the file.
2) GOSUB WRITE. This creates readiness for a file write, as opposed to a display write. That is, any subsequent PRINT statements before the next DOS command will write to the file and not appear on the screen. (To debug, it is possible to see on the screen the values that are being written to the disk by turning on the monitor.)
3) PRINT. The value is written to the file via the buffer. Remember, the write DOS command traps all print statements until any other DOS statement is executed.
4) GOSUB CLOSE. The file is closed, meaning that all the data in the buffer has been written to disk and that the buffer area is now free to be reassigned. The write to file is turned off.

In Program 1, a simple write is accomplished in lines 200-230. Similarly, a READ is shown in lines 300-330. Since F$ was defined in line 210, it could have been deleted from line 310 as long as no changes were made to F$ before 310.

The disk commands and input/output of the disk file can be monitored (made to appear on the screen) by using the MON and NOMON commands which are explained in the Disk II documentation. Having the monitor on is a good way to see the disk file manipulations in the learning or debugging states. A perfected program usually has at its beginning the NOMON command to turn off the monitor.

The following two notes refer to integer BASIC.

Note #1: You may wonder why Statement 220 does not use PRINT X1, X2, X$. It is an unfortunate thorn in the DOS which requires a separate PRINT statement for each entry, since otherwise a data separator is not printed on the file between the data entries. For example, PRINT 1,2 will put "12" on file as a single entry. In other words, PRINT A,B will not have the same effect as PRINT A: PRINT B if you are in the disk write mode. However, the same is not true for a disk read; INPUT A,B is identical to INPUT A: INPUT B.

Note #2: Keeping D$ =" " (see 70) alone on a separate line is a safety measure. The CONTROL-D does not appear in the screen (but it is there if you put it there), and if the line were copied over using the Apple editing wizardry the CONTROL-D would be lost.

File Structure

There are some limitations to sequential file processing. Consider the case where you find a transaction for $119.58 to be incorrect — it should be $9.58. This requires that all subsequent transactions of the file will have to be moved because the $9.58 takes up less space.

To understand this, let's see precisely how files are set up byte by byte. In Apple files, numbers are stored as a string; 119.58 would take up six bytes, and 9.58 would take up only four. E-notation numbers are real hogs, and at worst they might take up 15 bytes. Strings are stored a character per byte.

```
>LIST
  0 REM  ---------PROGRAM 1------------
  1 REM
  2 REM  WRITTEN IN INTEGER BASIC
  3 REM
  5 REM  READ/WRITE FILE EXAMPLE
  6 REM
 10 GOTO 60
 20 PRINT D$;"OPEN";F$: RETURN
 30 PRINT D$;"READ";F$: RETURN
 40 PRINT D$;"WRITE";F$: RETURN
 50 PRINT D$;"CLOSE";F$: RETURN
 60 OPEN=20:READ=30:WRITE=40:CLOSE=50
 70 DIM D$(1):D$=""
 80 REM
 90 REM
100 DIM X$(7),A$(7),F$(5)
110 X1=5:X2=10:X$="EXAMPLE"
180 REM
190 REM
200 REM  SEQUENTIAL WRITE EXAMPLE
210 F$="FILE1": GOSUB OPEN
220 GOSUB WRITE: PRINT X1: PRINT X2: PRINT X$
230 GOSUB CLOSE
280 REM
290 REM
300 REM   SEQUENTIAL  READ  EXAMPLE
310 F$="FILE1": GOSUB OPEN
320 GOSUB READ: INPUT A1,A2,A$
330 GOSUB CLOSE
380 REM
390 REM
400 PRINT A1,A2,A$
410 END
```

As any number or string is written to the disk, a 1 byte mark is placed to separate it from other numbers or strings. Thus, a number or string takes up its length plus one. See Figure 1 for an illustration of a file.

If you want to write the 9.58 value in the file where the 119.58 is now located, you would need to use the B parameter provided in the disk READ format. After the file has been opened, the command below will accomplish the write, to the file names TF.

PRINT D$; "WRITE TF, B29"

However, the file now has an extra number (8 at byte 35) as shown in Figure 2. This throws the sequence totally out of whack since a sequential read would incorrectly read 8 to be the transaction number of the second transaction. Now you can see why the subsequent transactions would all need to be moved back two bytes.

Since you can move anywhere with the B parameter, the R and L might seem superfluous. However, using R and L is usually more convenient. Let's use the mailing list as an example. The R would be the record number (a name and address), the L would be the length of each entire record, and the B is used to move inside a record. The length of a record in this case is 93. The direct access operates by using the current L (given in OPEN), the current R and B (given in WRITE or READ), and moves to the L * R + B + 1th byte. This is an absolute count from the beginning of the file.

Program 2 shows a simplistic program to create and change a data file, using direct access manipulations. In particular it solves the problem of quickly and easily changing Cher's name or address. Since the data is all character string, the program could have been written in integer BASIC. However, to exhibit the modifications necessary for programs with floating point data, program 2 is written in APPLESOFT II.

If a listing is not requested, program 2 can be used to fill a data file. If a listing is requested of a record which has not been previously written to, an error will occur. This program is not set up to protect records, so that you can use it to input records longer than 90 bytes and then use the list to see how it clobbered the next record. It is also not intended to be an actual application program, since it has no search or sort capabilities. However, by modifying and exercising it in various ways, you will be able to discover the ins and outs of file transactions.

Note #3: While APPLESOFT II is an extended language, it does not allow a variable for a line number in a GOSUB statement even though this is permissible in integer BASIC. While this makes

Figure 1

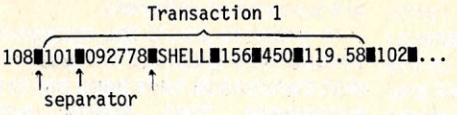
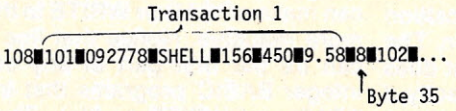


Figure 2




```
]LIST
0  REM ------PROGRAM 2-------------
1 :
2  REM  WRITTEN IN APPLESOFT II
3 :
5  REM  DIRECT ACCESS FILE EXAMPLE
6 :
10  GOTO 60
20  PRINT D$;"OPEN";F$;",L";L: RETURN
30  PRINT D$;"READ";F$;",R";R;",B";B: RETURN
40  PRINT D$;"WRITE";F$;",R";R;",B";B: RETURN
50  PRINT D$;"CLOSE";F$: RETURN
60 D$ =  CHR$ (4)
80  DIM A$(2):L = 93
90  INPUT "FILE NAME=";F$
100  INPUT "RECORD NUMBER=";R
110  INPUT "DO YOU WANT A LISTING (Y/N)?";T$
120  IF T$ <  > "Y" THEN 180
125  REM  --------PRINT RECORD----------------
130  GOSUB 20: REM  OPEN
140  FOR J = 0 TO 2
150 ::B = J * 31: GOSUB 30: REM  READ
155 :: INPUT A$(J)
160  NEXT
165  GOSUB 50: REM  CLOSE
170  PRINT : PRINT A$(0): PRINT A$(1): PRINT A$(2): PRINT
175  REM -------INPUT OR CHANGE ENTRIES-------
180  PRINT "HIT RETURN WHEN NO CHANGE REQUIRED"
190  INPUT "NEW NAME= ";A$(0)
200  INPUT "NEW STREET ADDRESS=";A$(1)
210  INPUT "NEW CITY/STATE/ZIP=";A$(2)
215  GOSUB 20:: REM  OPEN
220  FOR J = 0 TO 2
230 :: IF  LEN (A$(J)) = 0 THEN 250
240 ::B = J * 31: GOSUB 40: REM  WRITE
245 :: PRINT A$(J)
250  NEXT
260  GOSUB 50: REM CLOSE
265  REM -------EXIT OR NEXT RECORD----------
270  PRINT : INPUT "(-1 TO END) NEXT RECORD=";R
280  IF R >  = 0 THEN 110
290  END
```

Figure 3

```
>LIST
   10 REM    EXAMPLE A
   20 DIM D$(1),A(5):D$=""
   30 PRINT D$;"OPEN F"
   40 FOR I=1 TO 5
   50 PRINT D$;"READ F"
   60 INPUT A(I)
   70 PRINT A(I)
   80 NEXT I
   90 PRINT D$;"CLOSE F"
  100 END
```

```
>LIST
   10 REM   EXAMPLE B
   20 DIM D$(1),A(5):D$=""
   30 PRINT D$;"OPEN F"
   40 FOR I=1 TO 5
   50 PRINT D$;"READ F,B0"
   60 INPUT A(I)
   70 PRINT A(I)
   80 NEXT I
   90 PRINT D$;"CLOSE F"
  100 END
```

the subroutine technique a little cumbersome, it is suggested that the GOSUB still be used but be followed by a remark to make it clear.

Note #4: In APPLESOFT II the print A,B not being equal to PRINT A: PRINT B is still with us. An exception is if A is long enough to cause PRINT A,B to print B on a new line of the screen then a separator is written. It is easiest to forget the exception and consistently use PRINT A: PRINT B.

Note #5: This program could trigger one of the early DOS bugs. If it will not execute past line 250, see your dealer or recent publications for the DOS patch.

Note #6: On the positive side, APPLESOFT II allows the comfort of seeing the previously hidden CONTROL-D. (See line 70.) A further welcome feature is the repeated colon acceptability as a means of indenting. All structured programmers please stand, applaud and whistle!

Note #7: If you want to input values to be written to the disk, the INPUT statement must be before the GOSUB WRITE, or else the input prompt (question mark) will be written to file and screw up the whole operation. Notice how the input was done prior to the write in Program 2. No error will result from using a PRINT after a GOSUB READ and before the INPUT statement.

Note #8: There is a record 0 which could have been used by the first record. However, having record 5 (for example) in position number 4 is awkward. Secondly, and more important, record 0 is a prime location to store maintenance information, such as the number of records in the file. A common and useful technique in many business programs is to store a copy of the last record of the file in this record 0 location.

Note #9: If a record has never had some of its bytes written upon these bytes will be end-of-file marks. This occurs even though there is more data down the road in another record.

Note #10: Files are dynamic so you don't need to worry about opening a small file and then later, as it grows, having it write over another file. Only when the disk is full does a problem occur. This is rare but could sneak up on you, since you might not know how big a file really is. The CATALOG command does list all files with a file size number, but it does not work properly, and the Gospel According to Apple is to simply ignore the file size number.

Note #11: Should you need a relative move (like move 10 more each time), the POSITION command will accomplish this and can be added as a subroutine just like the other commands have subroutines.

Note #12: Sequential file processing can take place only when there is no R and/or B parameter in the READ or WRITE. For example, in Figure 3 (Example A) the first five values in the file will be read. However, in Example B the same first value in the file will be repeatedly read for all five inputs. Thus if your program uses both sequential and direct access it is not possible to use the direct access set up and put R = 0 and b = 0 to create the sequential mode. The sequential read and write can have and use their own individual subroutines.

With the direct and sequential access to large data bases, you are now able to do some heavy data processing. Let the Disk II allow you to take a big bite of data, and remember the slogan: "Old Apple users never die, they just lose their byte." ■

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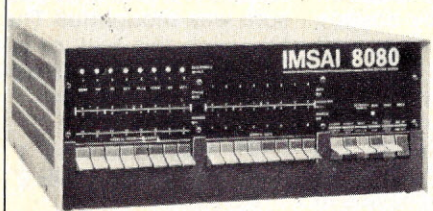

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The "Do-It-Yourself" Data Base System From Cromemco

John Craig

Versatility and flexibility are nice accolades when describing a piece of software but they take on new meaning after you've actually used and applied Cromemco's new Data Base Management System.

I have a confession to make. I don't own a Cromemco system. Usually, when I get software for review I search through my authors files until I find someone who has the right system ... and I ask if they would be interested in reviewing the package. When I received this Data Base Management System from Cromemco I looked over the manual and decided that it looked good! So good, in fact, that I wanted to check it out for myself and see if using the product was as easy as the manual made it look. It is.

A friend was kind enough to let me use his system for evaluating the package and now I wish I did have a Cromemco ... just for running this software! Here's why...

"People-oriented" software

I get excited (well, very interested) when I encounter software which is consumer-oriented and easy to use. This data base program is definitely not aimed toward programmers, but toward the end-user ... the businessman or home user with little or no computer background. As a result the software is useable by *everyone*; the programmer, the businessman and everyone else! The intended audience is evident throughout the manual. There aren't any dangerous assumptions made. For example, in the beginning a clear definition of field, record and file is provided, along with an example for reinforcement (see Figure 1). Many such definitions are found throughout the manual.

Cromemco's Data Base Management System runs under their disk operating system (CDOS) and 16K Extended Basic. Unfortunately, this piece of software, and others coming out of Cromemco, aren't being offered to the non-Cromemco world. It's intended for Cromemco users and for running under CDOS (which is a CP/M compatible operating system in that it runs CP/M software... but things don't necessarily work the other way.)

The user-oriented approach is evident when the system is first brought up and a menu of programs is presented on the screen (see Figure 2). To select one of the nine functions of the system you simply type the proper number ... and away you go!

Creating a System

The strength and flexibility of the system lies in this feature. It allows you to specify what you want each field to represent, how long you want it to be, whether or not it is to be sorted on and whether it is numeric or alpha data. A Data Base Definition Worksheet is provided as an appendix to the manual for helping you set up your data base.

This ability to be able to specify the characteristics of each field means the data base system can be configured for a number of different, and unrelated, functions. For example, it could be used for inventory control as easily as an accounts receivable program. One of the simplest applications would be to use the program for creating and maintaining customer mailing lists. Other applications include general ledger charge of accounts, personnel records, client records, patient histories, student records, stamp or coin collection information. The most important feature is that the data can be laid out and specified by anyone (i.e., a professional programmer isn't necessary). And ... since this one package will perform such a wide range of functions it simply means the user makes as many copies of the program as he has applications for it. This, instead of going out and having to buy all of those programs.

Getting it in ... and getting it out

Entering new data (function 3) is beautiful in its simplicity. Each field is displayed, along with its type (alpha or numeric) and length. The operator simply enters the data after being prompted by the name of each field. The data, when written onto the disk, will automatically have sort keys generated and stored into the sort files. This sometimes leads to an objectionable delay and can be omitted.

Function 4 allows the user to set up sort files and specify which fields are to be sorted upon. For example, if the Personnel Manager wanted a list of all employees hired after a certain date, a list of employees by date of hire, an alphabetical listing of employees, and so on, it would be a simple matter of specifying the proper field(s) to sort on to achieve those results.

Changing and deleting records (function 5) is quite easy since they have a "built-in" editor for that purpose (which is more extensive than what I've seen on other data base systems). With single commands you can examine the next sequential record, the previous record, jump ahead or back a specified number of records and change or delete records.

Getting a hard-copy of the data in a file involves using the CP/M "Control P" directive while in function 6 (Data Base Inquiry). You can specify only certain fields from each record to be printed out... and sorted to your liking. For example, an Editor (I can't imagine who) might want a list of names and phone numbers of all authors who own S-100 systems with dual-disks and printer.

Mailing labels

They didn't have to include this feature in a data base package ... but it sure was thoughtful! The only criteria for using this feature is that the first seven fields of each record contain the following information:

#1 NAME
#2 ADDRESS LINE 1
#3 ADDRESS LINE 2
#4 CITY
#5 STATE (TWO LETTERS)
#6 ZIP CODE
#7 COUNTRY

Field #'s 8, 9 and so on can be used for customer data to be sorted on (as in Figure 1). For example, if we had the program set up to handle accounts receivable, Field #8 might be the due date and we could sort on all those accounts which are overdue past a certain date. One of the nice features of this mailing label program is the fact that a blank line isn't printed in the event a field is empty. In many cases Address Line 2 is not used ... and who wants a blank line there when the label is printed? (Unfortunately, some label programs do it that way.) Another good

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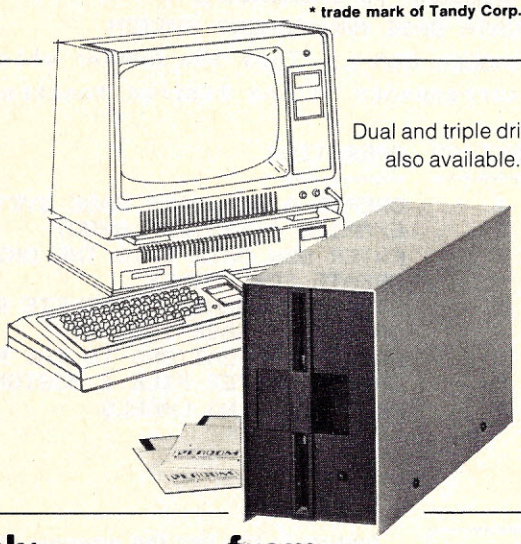

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Figure 1. Field, record and file defined.

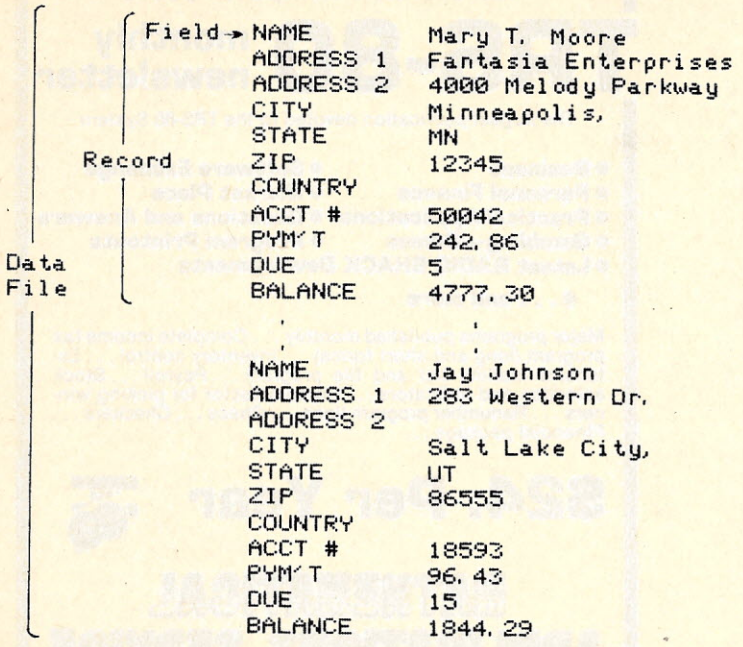

Figure 2. The menu.

```
WELCOME TO CROMEMCO'S
DATA BASE MANAGEMENT SYSTEM
(MODEL DBM-L) Type the number which
corresponds to the desired function:

FUNCTION  OPERATION
--------  ---------
   1      CREATE A NEW DATA BASE SYSTEM
   2      EXAMINE A SYSTEM LAYOUT
   3      ENTER NEW DATA INTO THE DATA BASE
   4      CREATE SORT FILES
   5      DISPLAY, CHANGE, & DELETE RECORDS
   6      DO A DATA BASE INQUIRY
   7      MAKE MODIFICATIONS TO THE MASTER
   8      CHANGE MASTER FILE & ASSIGN DRIVE
   9      PRINT MAILING LABELS
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feature is the fact the program allows for different sized labels and printing names and addresses on hand-fed envelopes.

Now for the bad...

The system is sadly lacking in report-generating capabilities. However, since the package sells for only $95 it's hard to get too upset about this and other shortcomings. There are only two kinds of printouts available from the system; mailing labels or selected fields when doing an inquiry (and using Control P). Cromemco is currently improving the program so that formatted printouts can be obtained. That will add a lot to the capabilities.

Another detrimental point is the fact that source code and listings of the program are not included. Quite often there are short, simple little modifications you'd like to go in and make to a Basic program. Apparently Cromemco felt the advantages to the customer (who is assumed to be a non-programmer anyway) didn't outweigh the disadvantages to Cromemco if the source were released.

Summary

I like the package. I can think of a dozen applications for it in my office and at least half a dozen for the home. The documentation is excellent and the program is easy to use. It's available for Cromemco's System Two (5" diskette) or System Three (8" diskette) with 48K RAM and sells for $95. The package can be ordered from any of Cromemco's dealers across the country or: Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94040. ■

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The Space Saver

Andrew Nicastro

This minicomputer program, and the ideas behind it, are applicable to micro systems in educational and business environments. Getting the most efficient use out of a time-share user's limited memory is always a worthy goal.

A goal of every good programmer is to create software that is easy to debug and, once completed, easy to read and understand — even months later. Techniques that achieve this clarity require longer programs in order to include sufficient documentation.

A mini-computer that simultaneously serves several users often does not provide adequate workspace for writing very large programs. For example, a PDP MU11V03, with maximum memory, operating under MU BASIC/RT-11, gives each of three users approximately a 7300 byte workspace. To save space, the *MU BASIC User's Manual* states:

> "Every character in a REM statement or a string constant requires one byte. To reduce program size minimize the number of characters in each. Each use of the multiple statement line saves six bytes. The program
>
> 10 A=3
> 20 B=4
>
> takes six bytes more than the equivalent program
>
> 10 A=3: B=4

Following these suggestions, however, conflicts with good programming practice. The program that follows gives the user the best of both possible worlds: On a one terminal system, he can create a program in an easy-to-debug linear fashion, that is, one statement per line, and document it liberally with REM statements; and he can have effortlessly a second running copy for a multi-terminal system that is economical in disk and memory requirements.

Andrew Nicastro is Director of Computer Assisted Learning at The American School of the Hague, High School Division, Paulus Buysstraat 51, The Hague, Netherlands.

Table One gives an indication of the savings. PACKER and PACK2 are the programs listed at the end of the article. BUFLO, CHARGE, MARKET and STERL are programs from the *Huntington II Project.* "Length" is the length in bytes given by BASIC's LENGTH command executed immediately after calling the program with the OLD command. "Disk Space" is the number of 512 byte blocks the program occupies determined by a disk directory listing under PIP with the /L switch. "Version with no REM statements" is the length with just REM statements deleted.

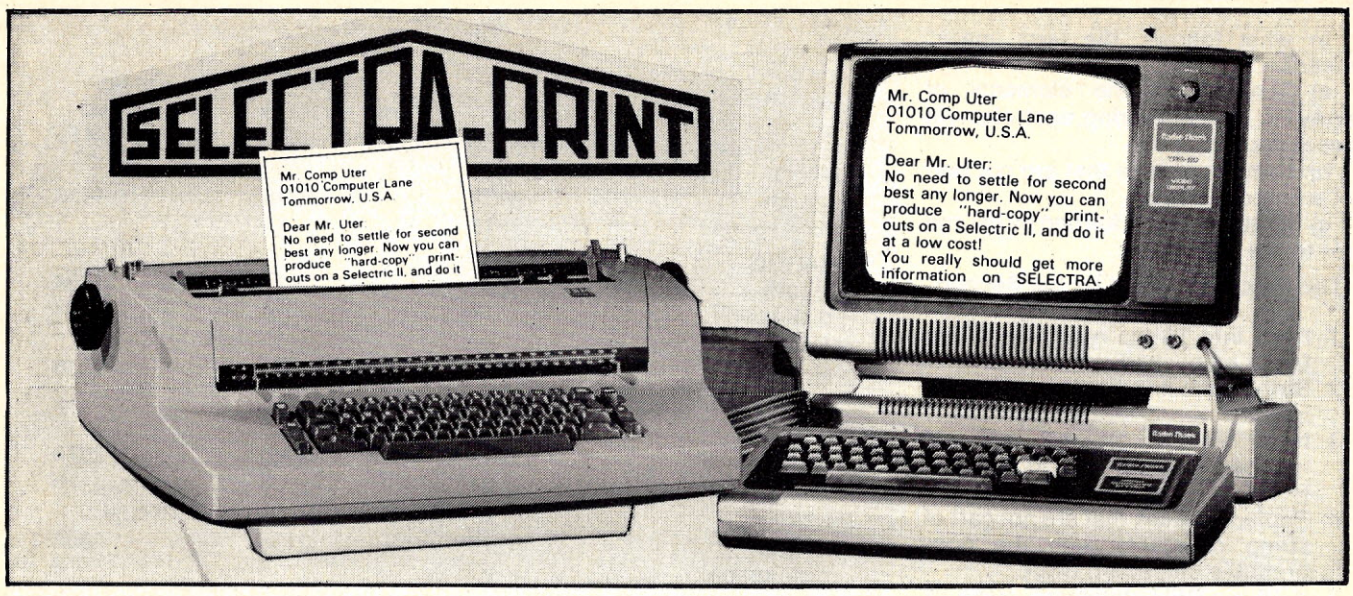
PACKER was developed at The American School of The Hague, where we use a PDP 11-03 for computer assisted learning. PACKER enables us to use most of our software on a three or four terminal system permitting several students to use a given program simultaneously. We keep a set of floppies with an unpacked back-up copy of each program for reference or modification.

How the Program Works

The packing program does two passes over the file to be packed. During the first pass, PACKER creates a table of referenced line numbers. During the second pass, PACK2 creates a new file from the original. PACK2 deletes REM statements unless they are referenced, abbreviates REM statements if they are referenced, deletes the keyword LET, writes as many statements as possible on one line, and deletes spaces that are not part of string constants. Neither pass alters the logical structure of a syntactically correct program, nor modifies the original file.

The Procedure Used by the First Pass (PACKER)

1. Present initial dialogue to ascertain needed information from the user.
2. Read the next[1] line from the file to be packed.
3. Isolate the line number.
4. If flag[2] F3=1, and the keyword is not REM, put the line number in the table of referenced line numbers, and set F3=0. Otherwise,
5. Separate any multiple statements storing each in an element of array T$(). Set N=the number of elements of T$() that are used.
6. Choose the next[1] element of array T$().
7. Look for the string GO, ON or IF occurring as a BASIC keyword.
8. If the keyword GO or ON occurs, isolate all referenced line numbers following it and store the line numbers in array L(); repeat 6, 7, 8.
9. If the keyword IF occurs,
   a) If THEN is *not* present, set flag[2] F3=1, isolate the GO TO statement and repeat 7, 8, 9.
   b) If THEN is present, and it is not followed by a line number, set flag[2] F3=1; isolate the statement following THEN; repeat 7, 8, 9.
   c) If THEN is present, and it is followed by a line number, isolate it and put it in array L().
10. Repeat 6, 7, 8, 9 until N elements have been processed.
11. Repeat 2, 3, 4, 5, 6, 7, 8, 9, 10 until end of file.
12. If the user has requested it, print the table of referenced line numbers.
13. Chain the second pass, PACK2; and, via the COMMON statement, pass the table of referenced line numbers and other pertinent information obtained in the initial dialogue.



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In what follows, the term "pack" means:

a) Concatenate the elements of array P$() into one string, each element separated by:

b) Remove spaces that are not part of string constants.

c) Write the string formed by (a) and (b) to the output file.

The Procedure Used by the Second Pass (PACK2)

1. Read into T$ the next[1] line of the file to be packed.
2. Strip off the line number and save it in L$.
3. Note whether or not the line number is referenced. If it is, set F=1.
4. Replace spaces that are not part of string constants with the non-printable character, BELL.
5. If T$ is a REM statement, make T$ null.
6. If T$ contains the keyword LET, remove all such occurrences.
7. If T$ contains a final REM statement, strip from: REM to the end of the line.
8. If T$ is null and the line number is not referenced, repeat 1 through 8.
9. If T$ is null and the line number is referenced,
   a) Set T$ = the line number + REM
   b) Pack P$(1) to P$(J)
   c) Put T$ in P$(1)
   d) Set L1 = the length of P$(1) minus the number of BELLs.
   e) Repeat 1 through 9 until end of file.
10. If T$ is not null and T$ is the first non-REM line of the file, do 9 c, d, e.
11. If T$ is not null and it is not the first non-REM line of the file, and the line number is referenced, repeat 9 b, c, d, e. Otherwise,
12. Add the length of T$ to L1, minus the number of BELLs plus 1 (for colon or backslash).
13. If L1 is less than or equal to the specified line length, put T$ in P$(J+1). Repeat 1 through 13.
14. If L1 is greater than the specified line length, repeat 9 b, c, d, e.
15. At end of file, pack P$(1) to P$(J).
16. Close all files and inform the user that packing is complete.

How to Use the Program

While none of the following assumptions are necessary conditions, for the sake of example the instructions given below assume:

1. PACKER and PACK2 are stored on the system disk with the .B extension, that is, as a BASIC program with public read and run access.

2. The name of the file to be packed (the input file) is SAMPLE.BAS; and it is stored on the system disk, DXO:.

3. The name of the file for the packed code (the output file) is SAMPK.B. It will be stored on disk DX1: with run and read access only.

4. The user is logged onto the system under userID AS, and is privileged; or MU BASIC is running without the HELLO feature.

Table One

	Original Version	Version with no REM statements	Version obtained from PACKER
BUFLO			
length	6102	5318	4418
disk space	13	11	9
CHARGE			
length	3290	974	794
disk space	7	4	3
MARKET			
length	7978	7302	6038
disk space	17	15	12
PACKER			
length	13036	3060	2676
disk space	27	8	6
PACK2			
length	11276	2138	1856
disk space	23	5	4
STERL			
length	7086	5122	4224
disk space	15	11	8

STEP 1 The Initial Dialogue

Type: RUN $PACKER

Response:

ENTER THE NAME OF THE FILE TO BE PACKED. USE THE FORM XXN: FILNAM.EXT. WHERE XX =THE DEVICE NAME. N=THE DEVICE NUMBER.

PACKER requests the name of the input file using the usual RT-11 file name descriptor. If the device name (XXN:) is not specified, MU BASIC assumes the system device. If the extension (.EXT) is omitted, MU BASIC assumes .DYY where YY is the current userID. (In the example, YY=AS.)

Type:

DX0:SAMPLE.BAS

Response:

ENTER THE NAME OF THE FILE FOR THE PACKED CODE USING THE SAME CONVENTIONS.

Type:

DX1:SAMPK.B

Response:

ESTIMATE THE NUMBER OF BLOCKS NEEDED FOR THE PACKED FILE.
HOW MANY?

If the length in bytes of the input file is known, using the conversion factor, 512 bytes per block, estimate the number of blocks. Choose a larger number than necessary. When PACKER closes the file, the system will automatically reduce the number of blocks to the actual number needed. If too large a number is used, however, line 220 of PACK2 may generate an error message depending on the system configuration — in particular, depending on the largest filesize permitted in an OPEN statement by the system manager.

Type: 10

Response:

THE MAXIMUM LINE LENGTH IS 132 CHARACTERS. HOW MANY CHARACTERS PER LINE?

PACKER requests the number of characters the user wants pass two to write on a line.

In some cases, a long line, though less than 132 characters, may generate a ?TLT (TOO LONG TO TRANSLATE) error message when the OLD or RUN command calls the packed file. (See STEP 3 for more information.) A line length from 120 to 125 characters works in most cases; but experiment with different values.

Type: 120

Response:

DO YOU WANT A PACKED LISTING AT THE TERMINAL (YES OR NO)?

The code that appears is an exact image of what is written to the output file. This code looks different from the code listed at the terminal by BASIC's LIST command. The former contains no spaces. The latter contains spaces which MU BASIC's translating routine inserts.

If a listing at pack time is desired,

Type: YES

If a listing at pack time is not desired,

Type: NO

Response:

DO YOU NEED TO ENTER LINE NUMBERS INTO THE TABLE OF REFERENCED LINE NUMBERS (YES OR NO)?

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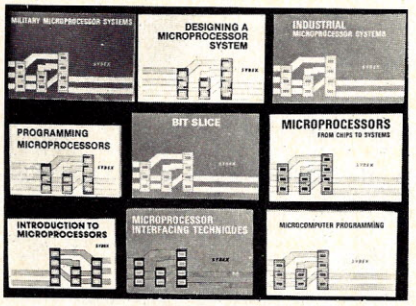

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There are three instances in which this should be done:

1. When line numbers are referenced by another program that calls the packed program. For example, a program which contains one of the following statements: CHAIN "SAMPK.B" LINE 270 or OVERLAY "SAMPK.B" LINE 270 requires that line number 270 be present in SAMPK. In our example, even if line 270 is not referenced by some other statement in program SAMPLE, 270 must be entered into the table of referenced line numbers.

2. When a user must modify a line of the program in his workspace. For example, a program that graphs functions may instruct the user to modify line 270. Though not absolutely necessary, line 270 and the next one should be entered into the table of referenced line numbers for the user's convenience.

3. When the packed file, called by the OLD or RUN command, causes BASIC to generate the ?TLT error message. (See STEP 3 for more details.)

If line numbers are *not* to be entered into the table of referenced line numbers,

Type: NO (Go to Step 2)

If line numbers are to be entered into the table of referenced line numbers,

Type: YES
Response: TYPE 0 TO STOP.
?
Type: 270 (for example)
Response: ?
Type: 0

STEP 2

Response:

PLEASE WAIT WHILE THE FIRST PASS BUILDS THE TABLE OF REFERENCED LINE NUMBERS.

At this point there will be a pause, its duration depending on the length of the input file. When each pass is complete, PACKER informs the user.

STEP 3 Testing the Packed File

At this time, the user *must* check the packed file by calling it with the OLD command. For our example,

Type: OLD DX1:SAMPK.B

If BASIC returns only the READY message, the file is a valid replica of the original program.

If BASIC returns the ?TLT error message, the user has two options:

1) Purge the packed file using the UNSAVE command; and rerun PACKER specifying a smaller number for line length.

2) The ?TLT error message may occur when, for example, a few lines containing either many parentheses or several FOR statements are written onto one line. An alternative to making all packed lines shorter consists of doing the following:

Call the packed file with the OLD command. Ignoring the ?TLT error

```
LIST

PACKER   2-JUN-78  MU BASIC/RT-11 V01-01C

1 REM                          PACKING PROGRAM
3 REM
5 REM
7 REM    VERSION 2
9 REM    MAY 1978
11 REM
13 REM
15 REM   PACKER  (PASS 1) BY
17 REM   ANDREW R. NICASTRO
19 REM   DIRECTOR OF COMPUTER ASSISTED LEARNING
21 REM
23 REM
25 REM   PACK2  (PASS 2) VERSION 1 BY
27 REM   DANIEL KERNS
29 REM   CLASS OF '79
31 REM   REVISED BY
33 REM   ANDREW R. NICASTRO
35 REM
37 REM   THE AMERICAN SCHOOL OF THE HAGUE
39 REM   HIGH SCHOOL DIVISION
41 REM   PAULUS BUYSSTRAAT 51
43 REM   THE HAGUE, NETHERLANDS
45 REM
47 REM
49 REM
51 REM                        PROGRAM DESCRIPTION
53 REM
55 REM   SEE 'HOW THE PROGRAM WORKS' IN THE ACCOMPANYING ARTICLE, "RUN
57 REM   AND STORE LARGE PROGRAMS IN LESS SPACE."
59 REM
61 REM
63 REM                          SPECIFICATIONS
65 REM
67 REM       THE PROGRAM WAS DEVELOPED ON A PDP MU11V03 WITH RX01 DUAL
69 REM   FLOPPY DRIVES, THE SYSTEM OPERATING UNDER MU BASIC/RT11 V01-01C.
71 REM
73 REM   VARIABLES:
75 REM   B    =  ESTIMATED FILESIZE FOR THE OUTPUT FILE.
77 REM   F1   =  FLAG; SET IF USER WANTS A PACKED LISTING AT THE TTY.
79 REM   F2   =  FLAG; SET IF USER WANTS A LIST OF REFERENCED LINE NUMBERS.
81 REM   F3   =  FLAG; SET IF THE LINE NUMBER OF THE NEXT NON-REM STATEMENT
82 REM           THAT FOLLOWS  IF...THEN  MUST BE SAVED AS A REFERENCED
83 REM           LINE NUMBER.
87 REM   I    =  INDEX FOR ARRAY L().
89 REM   L    =  LENGTH OF THE PACKED LINE.
91 REM   M    =  300 = SIZE OF L().
93 REM   N    =  THE NUMBER OF ELEMENTS USED IN T$().
94 REM
95 REM   STRING VARIABLES:
97 REM   I$   =  NAME OF THE INPUT FILE.
99 REM   L$   =  LINE NUMBER AS A STRING.
101 REM  O$   =  NAME OF THE OUTPUT FILE.
103 REM  T$   =  INPUT VARIABLE FOR EACH LINE IN THE INPUT FILE.
105 REM       =  T8$, T9$, T0$, T1$ IN SUBROUTINES 8010, 9010, 10010,
107 REM          11010 RESPECTIVELY.
109 REM
111 REM  ARRAYS:
115 REM  L()  =  TABLE OF REFERENCED LINE NUMBERS.
117 REM  T$() =  A STRING ARRAY USED TO HOLD EACH STATEMENT ON A GIVEN
119 REM          LINE THAT IS CURRENTLY IN T$.
121 REM
123 REM  V, W, X, Y, Z, AND X$, Y$, Z$ ARE SCRATCH VARIABLES.  THEIR CON-
125 REM  TENTS ARE USED FOR SHORT DURATIONS.
127 REM
129 REM  BASIC FUNCTIONS:
131 REM  POS, SEG$, TRM$, VAL.
133 REM
135 REM  MEMORY AND DISK REQUIREMENTS:
137 REM  SEE TABLE 1 IN THE ACCOMPANYING ARTICLE.
139 REM
141 REM
143 REM
160 COMMON L(300),L,I,F1,B,I$,O$
170 DIM T$(30)
180 M=300
190 B=0 \ F1=0 \ F2=0 \ F3=0 \ I=0 \ L=0
200 REM --- LINES 210-440  COLLECT FROM THE USER ALL PERTINENT INFORMATION
202 REM                    NEEDED TO PACK THE FILE.
210 PRINT  \ PRINT 'ENTER THE NAME OF THE FILE TO BE PACKED.'
220 PRINT 'USE THE FORM  XXN:FILNAM.EXT WHERE'
230 PRINT 'XX = THE DEVICE NAME,  N = THE DEVICE NUMBER.'
240 INPUT I$
250 PRINT \ PRINT 'ENTER THE NAME OF THE FILE FOR THE PACKED CODE USING THE
SAME CONVENTIONS.'
260 INPUT O$
270 PRINT \ PRINT 'ESTIMATE THE NUMBER OF BLOCKS NEEDED FOR THE PACKED FILE.
```

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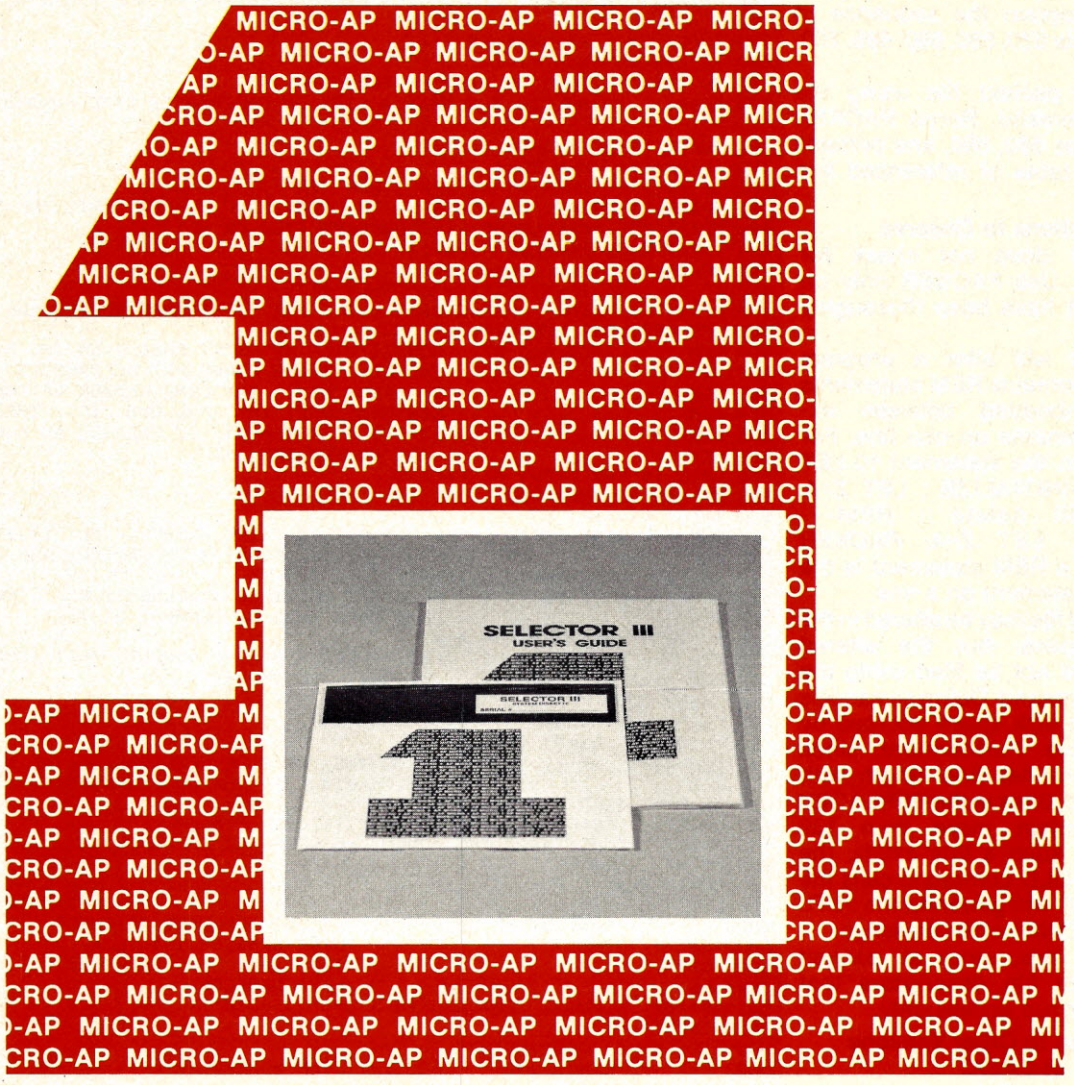

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CIRCLE 127 ON READER SERVICE CARD

message, LIST the file at the terminal. By examining the last printed line, determine what the *next* line number would have been.

Suppose the next line number would have been 670, and that in the original unpacked program the sequence of line numbers is 670, 680, 690, 695, 700, etc.

Purge the packed file using the UNSAVE command. Rerun PACKER and enter lines 680, 690, and perhaps 695 into the table of referenced line numbers.

Precautions to Observe

1) PACKER does not check for syntax errors. Use PACKER only on programs that have been thoroughly debugged.

2) PACKER will alter a program logically if it contains REM statements that are embedded between executable statements on one line. For example, given the statement 10 LET X=2 : REM---INITIALIZE : LET Z=4, PACKER will delete : REM---INITIALIZE : LET Z=4. PACKER assumes that a REM statement is the last or only statement on a line.

3) A packed file may be altered in the user's workspace; but the altered version should not be filed using the REPLACE command. Doing so cancels the savings in disk space accrued by deleting spaces. Furthermore, since PACK2 determines line length with spaces deleted, lines in the REPLACEd file may contain more than 132 characters. If such a line exists, the next time the OLD command calls the file, MU BASIC will generate the ?LTL (LINE TOO LONG) error message.

To prevent this, store all packed programs with file descriptors that permit read or run access only.

Adaptation to Other Versions of BASIC

To adapt PACKER and PACK2 to other versions of BASIC, use the procedures given in the section, "How the Program Works," and the comments in the program listing as guidelines. The following notes will clarify aspects of MU BASIC that may differ in other versions.

Functions

The programs use the BASIC functions CHR$, LEN, POS, SEG$, TRM$, and VAL. Descriptions follow with an example of each. The descriptions are from Digital Equipment Corporation's *MU BASIC/RT-11 User's Manual,* page B-8

CHR$ (expr)
Generates a 1-character string whose ASCII value is the low-order 8 bits of the integer value of expr.
Example: 10 LET X$ = CHR$(65)
assigns an A to X$.

LEN (string expr)
Returns the number of characters in the string expr.

```
280 PRINT 'HOW MANY ';
290 INPUT R
310 PRINT  \ PRINT 'THE MAXIMUM LINE LENGTH IS 132 CHARACTERS.'
320 PRINT 'HOW MANY CHARACTERS PER LINE ';
330 INPUT L
335 IF L>132 THEN 310
340 PRINT \ PRINT 'DO YOU WANT A PACKED LISTING AT THE TERMINAL (YES OR NO)
';
350 INPUT X$ \ X$=SEG$(X$,1,1)
360 IF X$='Y' THEN F1=1
365 IF X$<>'Y' THEN IF X$<>'N' THEN 340
370 PRINT \ PRINT 'DO YOU WANT A LIST OF REFERENCED LINE NUMBERS(YES OR NO)
 ';
380 INPUT X$ \ X$=SEG$(X$,1,1)
390 IF X$='Y' THEN F2=1
395 IF X$<>'Y' THEN IF X$<>'N' THEN 370
410 PRINT  \ PRINT 'DO YOU NEED TO ENTER LINE NUMBERS INTO THE TABLE'
420 PRINT 'OF REFERENCED LINE NUMBERS (YES OR NO) ';
430 INPUT X$ \ X$=SEG$(X$,1,1)
440 IF X$='Y' THEN  GOSUB 5010
445 IF X$<>'Y' THEN IF X$<>'N' THEN 410
450 PRINT  \ PRINT 'PLEASE WAIT WHILE THE FIRST PASS BUILDS THE TABLE OF
 REFERENCED LINE NUMBERS.'
500 REM --- LINES 510-570  CONSTITUTE THE FIRST PASS OVER THE FILE TO BE
502 REM                    PACKED.  THESE LINES PUT REFERENCED LINE NUMBERS
503 REM                    IN ARRAY L().  THE LINE NUMBER OF THE NEXT NON-
504 REM                    REM STATEMENT THAT FOLLOWS  IF...THEN XXX, WHERE
505 REM                    XXX IS A STATEMENT, IS TREATED AS A REFERENCED
506 REM                    LINE NUMBER (F3=1).
510 OPEN I$ FOR INPUT AS FILE 1
520 IF END #1 THEN 610
530 INPUT #1,T$
537 REM --- LINE 540:      STRIP OFF THE LINE NUMBER.  PUT IT IN L() IF
538 REM                    F3=1 AND THE FIRST 3 CHARACTERS ARE NOT 'REM'.
540 X$=T$ \ GOSUB 6010 \ T$=X$
542 REM --- LINE 550:      SEPARATE MULTIPLE STATEMENTS PER LINE , AND
544 REM                    LOAD EACH INTO AN ELEMENT OF T$().
550 X$=T$ \ GOSUB 7010 \ N=X
552 REM --- LINE 560:      PUT REFERENCED LINE NUMBERS THAT APPEAR IN THE
554 REM                    CURRENT LINE IN L().
560 GOSUB 8010
570 GO TO 520
610 PRINT  \ PRINT
612 REM --- LINE 620:      WRITE THE TABLE OF REFERENCED LINE NUMBERS AT
614 REM                    THE TERMINAL IF THE USER REQUESTED IT (F2=1).
620 IF F2=1 THEN  GOSUB 13010
630 PRINT  \ PRINT 'THE FIRST PASS IS COMPLETE.'
640 PRINT 'PLEASE WAIT ONE MOMENT WHILE PASS2 IS LOADED.'
650 PRINT  \ PRINT
660 CHAIN 'PACK2.B'
670 REM ------------------------------------------------- END MAIN PROGRAM.
5000 REM --- SUBROUTINE 5010-5060  ALLOWS THE USER TO ENTER
5002 REM                          LINE NUMBERS INTO L(),
5004 REM                          THE TABLE OF REFERENCED
5006 REM                          LINE NUMBERS.
5010 PRINT  \ PRINT 'ENTER 0 TO STOP.' \ PRINT
5020 INPUT L$
5030 IF L$='0' THEN RETURN
5032 REM --- LINE 5040:     PUT THE LINE NUMBER IN L().
5040 GOSUB 12010
5050 GO TO 5020
5060 REM ------------------------------------------------- END SUBROUTINE 5010
6000 REM --- SUBROUTINE 6010-6050  ISOLATES AND STRIPS OFF THE
6002 REM                          LINE NUMBER.  IT RETURNS THE LINE
6003 REM                          NUMBER IN Y$, AND THE LINE, WITHOUT
6004 REM                          LINE NUMBER, IN X$.
6008 REM --- LINE 6010:  V POINTS TO THE LAST DIGIT OF THE LINE NUMBER.
6010 V=POS(X$,' ',1)-1
6020 Y$=SEG$(X$,1,V)
6030 X$=SEG$(X$,V+1,255)
6032 REM --- LINE 6040:  IF F3=1, THE PREVIOUS LINE WAS OF THE FORM
6033 REM                IF...THEN XXX, WHERE XXX IS A STATEMENT.  THUS
6034 REM                SAVE THE LINE NUMBER OF THE NEXT NON-REM STATE-
6035 REM                MENT.
6040 IF F3=1 THEN IF SEG$(X$,2,4)<>'REM' THEN F3=0 \ L$=Y$ \ GOSUB 12010
6050 RETURN
6060 REM ------------------------------------------------- END SUBROUTINE 6010
7000 REM --- SUBROUTINE 7010-7090  SEPARATES ANY MULTIPLE STATEMENTS
7001 REM                          ON A LINE.  IT STORES EACH STATEMENT
7002 REM                          IN T$().  IT RETURNS THE NUMBER OF
7003 REM                          STATEMENTS ON THE GIVEN LINE TO N VIA X.
7004 REM                          IT EXPECTS X$ STRIPPED OF THE LINE
7005 REM                          NUMBER.
7006 REM --- X = THE NUMBER OF STATEMENTS ON THE LINE IN X$.
7008 REM --- Y = THE POSITION OF THE FIRST OCCURRENCE OF BACKSLASH
7009 REM          IN THE REMAINING STRING IN X$.
7010 X=0
7030 Y=POS(X$,'\',1)
7040 IF Y=0 THEN X=X+1 \ T$(X)=X$ \ RETURN
7050 X=X+1
7060 T$(X)=SEG$(X$,1,Y-1)
7070 X$=SEG$(X$,Y+1,255)
```

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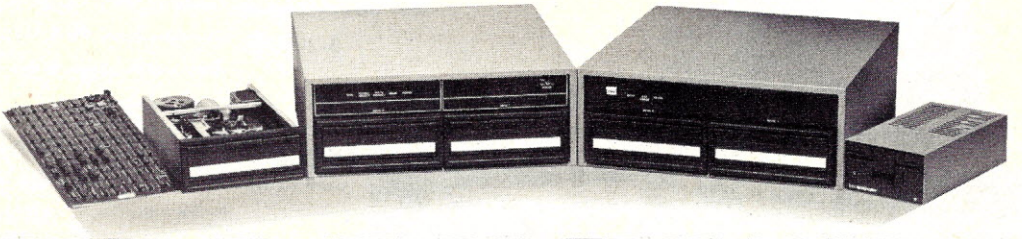

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CIRCLE 136 ON READER SERVICE CARD

Example: 10 LET X = LEN ('ABCDE')
assigns 5 to X.

POS (string exprl, string expr2, expr)
Searches for and returns the position of the first occurrence of string expr2 in string expr1. The search starts at the expr character position in string expr1.
Example: 10 LET X = POS ('ABCDE', 'B', 1)
assigns 2 to X.
20 LET X = POS('ABCDE', 'B', 3)
assigns 0 to X.

SEG$ (string expr, expr1, expr2)
Returns the string ot characters in positions expr1 through expr2 in string expr.
Example: 10 LET X$ = SEG$ ('ABCDE', 2, 3)
assigns BC to X$.

TRM$ (string expr)
Returns string expr without trailing blanks.
Example: 10 LET X$ = 'ABC '
10 LET Y$ = TRM$ (X$)
assigns ABC to Y$.

VAL (string expr)
Returns the value of the decimal number contained in the string expr.

```
7090 REM ------------------------------------------------------ END SUBROUTINE 7010
8000 REM --- SUBROUTINE 8010-8090 SCANS EACH STATEMENT ON THE GIVEN LINE
8002 REM                         FOR KEYWORDS THAT MAY INDICATE REFER-
8004 REM                         ENCED LINE NUMBERS.  EACH STATEMENT IS IN
8006 REM                         AN ELEMENT OF T$().
8008 REM --- N POINTS TO THE LAST OCCUPIED ELEMENT OF T$().
8010 FOR W=1 TO N
8020 T8$=T$(W)
8022 REM --- LINE 8030:    TRIM LEADING AND TRAILING BLANKS.
8030 T9$=T8$ \ GOSUB 9010 \ T8$=T9$
8032 REM --- LINES 8040-8070  ISOLATE THE FIRST TWO ALPHA-NUMERIC
8033 REM                     CHARACTERS IN THE STATEMENT IN T$(W)
8034 REM                     AND CHECK FOR KEYWORDS THAT MAY INDICATE
8035 REM                     REFERENCED LINE NUMBERS.
8037 REM --- SUBROUTINE 10010 PUTS ALL REFERENCED LINE NUMBERS THAT ARE
8038 REM                     IN THE GIVEN STATEMENT IN L().
8039 REM --- SUBROUTINE 11010 PROCESSES IF...THEN STATEMENTS.
8040 Y$=SEG$(T8$,1,2)
8050 IF Y$='GO' THEN TO$=T8$ \ GOSUB 10010
8060 IF Y$='ON' THEN TO$=T8$ \ GOSUB 10010
8070 IF Y$='IF' THEN T1$=T8$ \ GOSUB 11010
8080 NEXT W
8090 RETURN
8095 REM ------------------------------------------------------ END SUBROUTINE 8010
9000 REM --- SUBROUTINE 9010-9030  TRIMS LEADING AND TRAILING BLANKS.
9010 T9$=TRM$(T9$)
9015 IF T9$='' THEN 9030
9020 IF SEG$(T9$,1,1)=' ' THEN T9$=SEG$(T9$,2,255) \ GO TO 9020
9030 RETURN
9040 REM ------------------------------------------------------ END SUBROUTINE 9010
10000 REM --- SUBROUTINE 10010-10120  SCANS A STATEMENT FOR REFERENCED
10001 REM                            LINE NUMBERS.  THE PARSING ROUTINE
10002 REM                            SCANS THE STATEMENT BACKWARDS
10003 REM                            BEGINNING WITH THE LAST CHARACTER.
10004 REM                            IF IT IS NON-NUMERIC, THERE ARE
10005 REM                            NO REFERENCED LINE NUMBERS.
10010 X=LEN(TO$)
10020 X$=SEG$(TO$,X,X)
10032 REM --- LINE 10040:  IF THE LAST CHARACTER OF THE LINE IS NOT NU-
10033 REM                  MERIC, RETURN.
10040 IF POS('0123456789',X$,1)=0 THEN RETURN
10051 REM --- LINES 10060-10110:  IF THE LAST CHARACTER IS NUMERIC THE
10052 REM                         SCAN CONTINUES UNTIL THE OCCURRENCE OF A
10053 REM                         SEPARATOR (COMMA OR SPACE). THE ROUTINE
10054 REM                         ISOLATES THE NUMBER AND, USING SUBROUTINE
```


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•

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–Frederick Hilpert, University of Wisconsin, Stevens Point

•

This program is complex enough to be good. It almost follows that therefore it is too complex to casually distribute without carefully worked out documentation and instruction. CONDUIT provided them.
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•

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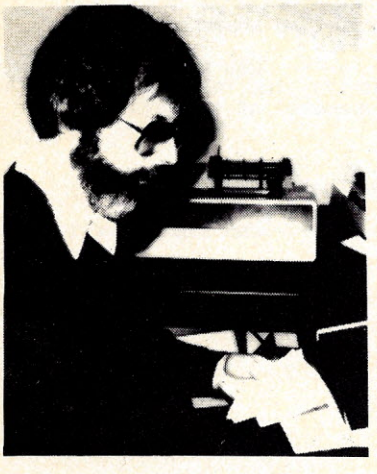

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CIRCLE 215 ON READER SERVICE CARD

Example: 10 LET X$ = '12.345'
20 LET X = VAL(X$)
assigns 12.345 to X.

Statements

In PACKER and PACK2, LET has been omitted. The statement 10 LET F = 0 appears as 10 F = 0.

PACKER requires the COMMON statement to preserve the table of referenced line numbers when chaining PACK2. If COMMON is not available, write PACKER and PACK2 as one program. Renumber the lines in PACK2 so that its code follows PACKER.

When multiple statements occur on a line containing the IF ... THEN statement, a line number following THEN determines a different flow of control than a statement.[2]

PACKER and PACK2 use the character : or / to separate multiple statements per line, and process files using that separator. Adaptation requires changing every occurrence of : or / to the appropriate character.

In MU BASIC, the keywords that reference line numbers in the same program are GOSUB, GO TO, IF ... THEN, ON ... GOSUB, and ON ... GO TO. If, in another version of BASIC, there are other such keywords, subroutine 8010-8090 in PACKER will require additional code.

In some other versions of BASIC such as DEC's Edusystem 30 for the PDP-8, quote (") or apostrophe (') functions as the keyword REM. Furthermore, some interpreters do not require a final delimiter for the last string constant in a PRINT statement. For example 10 PRINT "ABC is a valid statement instructing the processor to write ABC at the terminal. PACK2 does not account for these situations. Statements such as

10 PRINT "THIS IS A STRING CONSTANT.
20 PRINT 'THIS IS A STRING CONSTANT.
30 "THIS IS A REM STATEMENT.
40 'THIS IS A REM STATEMENT.

will cause infinite looping in subroutine 17000-17520.

File Operations

Statements for file operations vary among different versions of BASIC. File operations occur in lines 510, 520, 530, and 660 of PACKER and in lines 210, 220, 250, 260, 620, and 20210 in PACK2. ■

```
10055 REM                              12010, STORES IT IN L(). THE ROUTINE THEN
10056 REM                              DELETES FROM THE SEPARATOR TO THE END OF
10057 REM                              THE LINE & REPEATS LINES 10010-10110
10058 REM                              UNTIL THE SEPARATOR IS A SPACE.
10060 FOR Z=X TO 1 STEP -1
10070 X$=SEG$(T0$,Z,Z)
10080 IF X$=' ' THEN L$=SEG$(T0$,Z+1,X) \ GOSUB 12010 \ RETURN
10090 IF X$=',' THEN L$=SEG$(T0$,Z+1,X) \ GOSUB 12010 \ T0$=SEG$(T0$,1,Z-1)
 GO TO 10010
10110 NEXT Z
10120 REM ------------------------------------------------- END SUBROUTINE 10010
11000 REM --- SUBROUTINE 11010-11140 PARSES THE IF...THEN STATEMENT.
11002 REM                            IT EXPECTS T1$ TRIMMED OF TRAILING
11004 REM                            AND LEADING  BLANKS.
11008 REM --- LINE 11010:  LOCATES THEN.
11010 X=POS(T1$,'THEN',1)+4
11012 REM --- LINE 11020:  THE STATEMENT IS  IF...GO TO.  SET F3=1 IN ORDER
11014 REM                  TO SAVE THE LINE NUMBER OF THE NEXT NON-REM
11016 REM                  STATEMENT AS A REFERENCED LINE NUMBER.
11018 REM                  SUBROUTINE 10010 GETS THE LINE NUMBER THAT
11019 REM                  FOLLOWS  GO TO.
11020 IF X=4 THEN F3=1 \ T0$=T1$ \ GOSUB 10010 \ RETURN
11022 REM --- LINES 11030-11040  ISOLATE THE STRING FOLLOWING THEN.
11024 REM                       SUBROUTINE 9010 TRIMS TRAILING
11026 REM                       AND LEADING BLANKS.
11030 T1$=SEG$(T1$,X,255)
11040 T9$=T1$ \ GOSUB 9010 \ T1$=T9$
11042 REM --- LINES 11050-11070  CHECK THE FIRST CHARACTER THAT FOLLOWED
11044 REM                       THEN. IF IT IS NUMERIC, SUBROUTINE
11046 REM                       10010 ISOLATES IT. SUBROUTINE 10010
11048 REM                       REQUIRES A BLANK BEFORE THE LINE NUMBER.
11050 X$=SEG$(T1$,1,1)
11070 IF POS('0123456789',X$,1)<>0 THEN T0$=' '+T1$ \ GOSUB 10010 \ RETURN
11072 REM --- LINES 11080-11140: THE FIRST CHARACTER AFTER  THEN  WAS NON-
11074 REM                       NUMERIC.  SET F3=1 SO THAT THE LINE NUMBER
11075 REM                       OF THE NEXT NON-REM STATEMENT IS SAVED
11076 REM                       AS A REFERENCED LINE.  ALSO CHECK FOR A
11077 REM                       KEYWORD THAT INDICATES REFERENCED LINE
11078 REM                       NUMBERS.  IF THE KEYWORD IS NOT IF, ON,
11079 REM                       GO, THERE ARE NO REFERENCED LINE NUMBERS.
11085 F3=1
11090 X$=SEG$(T1$,1,2)
11110 IF X$='IF' THEN 11010
11120 IF X$='ON' THEN T0$=T1$ \ GOSUB 10010
11130 IF X$='GO' THEN T0$=T1$ \ GOSUB 10010
11140 RETURN
11150 REM ------------------------------------------------- END SUBROUTINE 11010
12000 REM --- SUBROUTINE 12010-12080 PUTS THE LINE NUMBER, L$, INTO
12001 REM                            THE TABLE OF REFERENCED LINE
12002 REM                            NUMBERS L(). IT UPDATES THE ARRAY'S
12003 REM                            INDEX, I. I POINTS TO THE LAST USED
12004 REM                            ELEMENT IN L().
12010 X=VAL(L$)
12012 REM --- LINES 12020-12040  ELIMINATE DUPLICATION IN L().
12020 FOR Y=1 TO I
12030 IF L(Y)=X THEN RETURN
12040 NEXT Y
12050 I=I+1
12060 L(I)=X
12070 IF I=M+1 THEN PRINT 'TOO MANY REFERENCED LINE NUMBERS.' \ STOP
12080 RETURN
12090 REM ------------------------------------------------- END SUBROUTINE 12010
13000 REM --- SUBROUTINE 13010-13050  WRITES L(), THE TABLE OF REFERENCED
13002 REM                            LINE NUMBERS, AT THE TTY.
13010 FOR X=1 TO I
13020 PRINT L(X),
13030 NEXT X
13040 PRINT  \ PRINT I;' REFERENCED LINE NUMBERS.'
13050 RETURN
13060 REM ------------------------------------------------- END SUBROUTINE 13010
32767 END

READY



LIST

PACK2   2-JUN-78  MU BASIC/RT-11 V01-01C

 1 REM                        PACKING PROGRAM
 3 REM                           PASS 2
 5 REM
 7 REM
 9 REM          THIS PROGRAM IS AN INTEGRAL PART OF PROGRAM PACKER.
11 REM
13 REM
15 REM   VARIABLES:
17 REM   B7     =  THE NUMBER OF BELLS INSERTED IN PLACE OF BLANKS THAT
19 REM             ARE NOT PART OF STRING CONSTANTS.
21 REM   F      =  FLAG; SET IF THE CURRENT LINE NUMBER IS IN L().
23 REM   F1     =  FLAG; SET IF THE USER WANTS A PACKED LISTING AT THE TTY.
25 REM   J      =  INDEX FOR ARRAY P$().
```

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```
27 REM   Q1    =  POSITION OF ' IN THE CURRENT LINE.
29 REM   Q2    =  POSITION OF " IN THE CURRENT LINE.
31 REM
33 REM   STRING VARIABLES:
35 REM   B$    =  CHR$(7) = BELL.
37 REM   L$    =  THE LINE NUMBER OF THE CURRENT LINE
39 REM   T$    =  INPUT VARIABLE FOR EACH LINE OF THE INPUT FILE.
41 REM         =  T9$ IN SUBROUTINE 9010.
43 REM
45 REM   ARRAYS:
47 REM   P$()  =  AN ARRAY THAT HOLDS EACH LINE OF THE INPUT FILE UNTIL
49 REM            SPECIFIED CONDITIONS PACK THEM INTO ONE LINE.
51 REM
53 REM   X, Y, X$, Y$ ARE SCRATCH VARIABLES.  THEIR CONTENTS ARE USED
55 REM   FOR SHORT DURATIONS.
57 REM
59 REM   BASIC FUNCTIONS:
61 REM   CHR$, LEN, POS, SEG$, TRM$.
63 REM
65 REM   FILE OPERATIONS:
67 REM   CLOSE, INPUT #, IF END #...THEN, OPEN.
69 REM
71 REM   MEMORY AND DISK REQUIREMENTS:
73 REM   SEE TABLE 1 IN THE ACCOMPANYING ARTICLE.
75 REM
77 REM
79 REM
210 OPEN I$ FOR INPUT AS FILE 1
220 OPEN O$ FOR OUTPUT AS FILE 2 FILESIZE B
230 DIM P$(45) \ J=0 \ L1=0 \ B$=CHR$(7)
240 F=0
242 REM --- LINE 250:       SESSION WRAP-UP AT END OF FILE.
250 IF END #1 THEN  GOSUB 610 \ STOP
260 INPUT #1,T$
262 REM --- LINE 270:       THE CURRENT LINE IS IN T$.  STRIP OFF THE
264 REM                     LINE NUMBER AND PUT IT IN L$.
270 X$=T$ \ GOSUB 15010 \ T$=X$ \ L$=Y$
272 REM --- LINE 280:       CHECK TO SEE IF THE LINE NUMBER IS REFER-
273 REM                     ENCED.  IF IT IS, SET F=1.
280 GOSUB 16010 \ F=X
282 REM --- LINE 290:       REPLACE BLANKS THAT ARE NOT PART OF A STRING
283 REM                     CONSTANT WITH CHR$(7)=BELL.  ALSO, PREFIX THE
284 REM                     LINE WITH A BELL.  MAKE T$ NULL IF IT CONTAINS
285 REM                     ONLY A REM STATEMENT.  RECORD THE NUMBER OF IN-
287 REM                     SERTED BELLS IN B7 (SEE SUBROUTINE 17010).
290 X$=T$ \ GOSUB 17010 \ T$=X$
292 REM --- LINE 310:       REMOVE THE KEYWORD, LET, FROM EACH STATE-
293 REM                     MENT IN T$, AND STRIP T$ FROM THE FIRST
294 REM                     OCCURRENCE OF REM TO THE END.
310 IF T$<>'' THEN X$=T$ \ GOSUB 18010 \ T$=X$
322 REM --- LINES 340-380:  IF T$ IS NULL REPEAT 240-340.
323 REM                     F=1 INDICATES THE LINE NUMBER IS REFERENCED.
324 REM                     IF F=1, PACK P$(1) TO P$(J); PUT T$ WITH
325 REM                     ITS LINE NUMBER IN P$(1); REPEAT 240-340.
326 REM                     J=0 INDICATES THAT T$ IS THE
327 REM                     FIRST LINE OF THE FILE OTHER THAN A
328 REM                     NON-REFERENCED REM STATEMENT. IF J=0
329 REM                     PUT T$ WITH ITS LINE NUMBER IN P$(1);
330 REM                     REPEAT 240-340.
340 IF T$='' THEN IF F<>1 THEN 240
342 REM --- LINE 350:  F=1, THAT IS, THE LINE NUMBER IS REFERENCED.
350 IF T$='' THEN T$=B$+'REM' \ GOSUB 20010 \ GO TO 510
352 REM --- LINES 360-370:  T$<>''
360 IF J=0 THEN 510
370 IF F=1 THEN  GOSUB 20010 \ GO TO 510
372 REM --- LINES 380-410:  T$<>''; F<>1; J<>0
374 REM
376 REM --- LINE 380:       B7=THE NUMBER OF BELLS INSERTED BY SUBROUTINE
378 REM                     17010. "+1" ACCOUNTS FOR BACKSLASH.
380 L1=L1+LEN(T$)-B7+1
382 REM --- LINES 390-410:  L=MAXIMUM LINE LENGTH.  IF L1<=L, STORE THE
384 REM                     CURRENT LINE IN P$(J+1); REPEAT 240-380.
385 REM                     IF L1>L, PACK P$(1) TO P$(J), AND STORE THE
386 REM                     CURRENT LINE IN P$(1); REPEAT 240-380.
390 IF L1<=L THEN J=J+1 \ P$(J)=T$ \ GO TO 240
410 IF L1>L THEN  GOSUB 20010
500 REM --- LINES 510-550  EXECUTE WHEN THE CURRENT LINE MUST BE FIRST,
501 REM                    THAT IS, EITHER WHEN L1>L OR L$ IS REFERENCED.
502 REM                    THE ROUTINE CONCATENATES L$ ONTO T$,
503 REM                    PUTS T$ IN P$(1),
504 REM                    SETS L1 = LENGTH OF T$ LESS THE NUMBER OF IN-
505 REM                              SERTED BELLS (B7).
506 REM                    SETS J  = 1, POINTING TO THE LAST USED ELEMENT
507 REM                              OF P$().
510 T$=L$+T$
520 P$(1)=T$
530 L1=LEN(T$)-B7
540 J=1
550 GO TO 240
560 REM ------------------------------------------------- END MAIN PROGRAM.
```

```
600 REM --- SUBROUTINE 610-720  SESSION WRAP-UP.
601 REM                        PACK ANY STATEMENTS REMAINING IN P$(1)
602 REM                        TO P$(J). CLOSE ALL FILES. RING BELL.
603 REM                        PRINT RELEVANT INFORMATION.
610 GOSUB 20010
620 CLOSE
630 FOR X=1 TO 50 \ PRINT CHR$(7); \ NEXT X
632 REM --- LINES 640-670:  IF THE DEVICE NAME IS NOT PRESENT IN THE
633 REM                     FILE NAME, PREFIX THE SYSTEM DEVICE NAME.
640 X=POS(I$,':',1)
650 IF X=0 THEN I$='DX0:'+I$
660 X=POS(O$,':',1)
670 IF X=0 THEN O$='DX0:'+O$
680 PRINT  \ PRINT
690 PRINT 'THE FILE THAT WAS PACKED IS  ';I$
700 PRINT 'THE PACKED PROGRAM IS STORED UNDER  ';O$
720 RETURN
722 REM ------------------------------------------- END SUBROUTINE 610
9000 REM --- SUBROUTINE 9010-9030  TRIMS LEADING AND TRAILING BLANKS.
9010 T9$=TRM$(T9$)
9015 IF T9$='' THEN 9030
9020 IF SEG$(T9$,1,1)=' ' THEN T9$=SEG$(T9$,2,255) \ GO TO 9020
9030 RETURN
9040 REM ------------------------------------------- END SUBROUTINE 9010
15000 REM --- SUBROUTINE 15010-15040  REMOVES THE LINE NUMBER FROM X$
15001 REM                            AND STORES IT IN Y$.
15008 REM --- LINE 15010  SEARCHES FOR THE FIRST BLANK IN THE LINE.
15010 X=POS(X$,' ',1)-1
15020 Y$=SEG$(X$,1,X)
15030 X$=SEG$(X$,X+1,255)
15040 RETURN
15050 REM ------------------------------------------- END SUBROUTINE 15010
16000 REM --- SUBROUTINE 16010-16060  CHECKS TO SEE IF L$, THE LINE
16001 REM                            NUMBER, IS IN L(I), THE TABLE OF
16002 REM                            REFERENCED LINE NUMBERS. IF L$ IS
16003 REM                            IN L(), IT SETS THE FLAG F=1 VIA X.
16010 X=0
16020 Y=VAL(L$).
16030 FOR Z=1 TO I
16040 IF Y=L(Z) THEN X=1 \ RETURN
16050 NEXT Z
16060 RETURN
16070 REM ------------------------------------------- END SUBROUTINE 16010
17000 REM --- SUBROUTINE 17010-17520  REPLACES BLANKS THAT ARE NOT PART
17001 REM                            OF STRING CONSTANTS WITH THE NON-
17002 REM                            PRINTABLE CHARACTER, CHR$(7)=BELL.
17003 REM                            IT ALSO DELETES REM STATEMENTS THAT
17004 REM                            ARE ALONE ON ONE LINE.IT COUNTS THE
17005 REM                            NUMBER OF INSERTED BELLS IN B7.
17008 REM --- LINE 17010:  TRIM LEADING AND TRAILING BLANKS.
17010 T9$=X$ \ GOSUB 9010 \ X$=T9$
17015 B7=0
17017 REM --- LINE 17020 DELETES STAND-ALONE REM STATEMENTS.
17020 IF SEG$(X$,1,3)='REM' THEN X$='' \ RETURN
17030 X=1
17040 Y=POS(X$,' ',X)
17042 REM --- LINE 17050: THERE ARE NO MORE BLANKS. PREFIX ONE BELL.
17043 REM                 EVERY LINE MUST CONTAIN A LEADING BELL BUT
17044 REM                 NOT A TRAILING BELL.
17050 IF Y=0 THEN X$=B$+X$ \ B7=B7+1 \ RETURN
17052 REM --- LINES 17060-17160 CHECK TO SEE IF THE CURRENT BLANK IS PART
17053 REM                       OF A STRING CONSTANT. IF IT IS, IT IS
17054 REM                       IGNORED. OTHERWISE IT IS REPLACED BY
17055 REM                       A BELL.
17056 REM                       STARTING FROM THE POINTER, X,
17057 REM                       Q1 = THE POSITION OF ',
17058 REM                       Q2 = THE POSITION OF ", AND
17059 REM                        Y = THE POSITION OF BLANK.
17060 Q1=POS(X$,"'",X)
17070 Q2=POS(X$,'"',X)
17080 IF Q1=0 THEN IF Q2=0 THEN 17510
17082 REM --- LINE 17090: THE LINE CONTAINS "; BUT BLANK PRECEDES THE
17083 REM                 FIRST OCCURRENCE.
17090 IF Q1=0 THEN IF Y<Q2 THEN 17510
17092 REM --- LINE 17110: THE BLANK IS EMBEDDED IN A STRING DELIMITED BY".
17093 REM                 MOVE THE POINTER, X, JUST BEYOND THE NEXT
17094 REM                 OCCURRENCE OF ".
17110 IF Q1=0 THEN X=POS(X$,'"',Q2+1)+1 \ GO TO 17040
17112 REM --- LINE 17120: THE LINE CONTAINS '; BUT THE BLANK PRECEDES THE
17113 REM                 FIRST OCCURRENCE OF '.
17120 IF Q2=0 THEN IF Y<Q1 THEN 17510
17122 REM --- LINE 17130: THE BLANK IS EMBEDDED IN A STRING DELIMITED BY'.
17123 REM                 MOVE THE POINTER, X, JUST BEYOND THE NEXT
17124 REM                 OCCURRENCE OF '.
17130 IF Q2=0 THEN X=POS(X$,"'",Q1+1)+1 \ GO TO 17040
17132 REM --- LINE 17140: THE LINE CONTAINS BOTH ' AND ", BUT THE BLANK
17133 REM                 PRECEDES THE FIRST OCCURRENCE OF BOTH.
17140 IF Y<Q1 THEN IF Y<Q2 THEN 17510
17142 REM --- LINE 17150: THE BLANK IS EMBEDDED IN A STRING WHICH
17143 REM                 CONTAINS "; BUT THE STRING IS DELIMITED BY '.
17144 REM                 MOVE THE POINTER, X, JUST BEYOND THE NEXT
17145 REM                 OCCURRENCE OF '.
```


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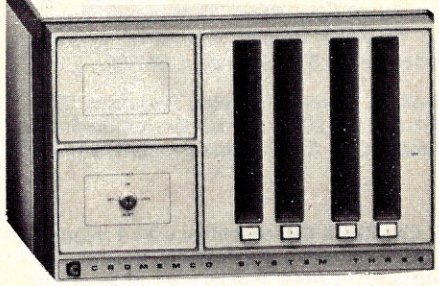
CROMEMCO SYSTEM 3



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```
17150 IF Q1<Q2 THEN X=POS(X$,"'",Q1+1)+1 \ GO TO 17040
17152 REM --- LINE 17160: THE BLANK IS EMBEDDED IN A STRING WHICH CONTAINS
17153 REM                 '; BUT THE STRING IS DELIMITED BY ". MOVE THE
17154 REM                 POINTER, X, JUST BEYOND THE NEXT OCCURRENCE OF ".
17160 X=POS(X$,"'",Q2+1)+1 \ GO TO 17040
17500 REM --- LINE 17510 REPLACES A GIVEN BLANK BY THE BELL CHARACTER.
17510 X$=SEG$(X$,1,Y-1)+B$+SEG$(X$,Y+1,255)
17515 B7=B7+1
17520 GO TO 17040
17522 REM ------------------------------------------- END SUBROUTINE 17010
18000 REM --- SUBROUTINE 18010-18050 REMOVES ALL OCCURRENCES OF THE
18001 REM                            KEYWORD, LET; AND IF THE LINE CONTAINS
18002 REM                            A FINAL REM STATEMENT, THE ROUTINE
18003 REM                            DELETES FROM REM TO THE END OF THE
18004 REM                            LINE.
18010 X=POS(X$,B$+'LET'+B$,1)
18020 IF X<>0 THEN X$=SEG$(X$,1,X)+SEG$(X$,X+4,255) \ GO TO 18010
18030 X=POS(X$,B$+'\'+B$+'REM',1)
18032 REM --- LINES 18040-18110:  FOR LINE-LENGTH ACCURACY, COMPENSATE
18034 REM                         FOR BELLS THAT ARE IN THE REM
18036 REM                         STATEMENT.
18040 IF X=0 THEN RETURN
18050 Y$=SEG$(X$,X,255)
18060 X$=SEG$(X$,1,X-1)
18070 X=1
18080 X=POS(Y$,B$,X)+1
18090 IF X<>1 THEN B7=B7-1 \ GO TO 18080
18110 RETURN
18120 REM ------------------------------------------- END SUBROUTINE 18010
20000 REM --- SUBROUTINE 20010-20230  IS THE PACKING ROUTINE.
20001 REM --- LINES 200110-20050 CONSTRUCT A SINGLE LINE FROM THE ELEMENTS
20002 REM                        OF P$(1) TO P$(J).
20003 REM --- LINES 20110-20120 REMOVE THE BELL CHARACTER, B$.
20004 REM --- LINES 20210-20230 WRITE THE LINE TO THE OUTPUT FILE,
20005 REM                       AND, IF THE USER SO INSTRUCTED,
20006 REM                       TO THE TTY.
20010 X$=''
20020 FOR X=1 TO J
20030 X$=X$+P$(X)
20040 IF X<>J THEN X$=X$+'\'
20050 NEXT X
20110 X=POS(X$,B$,1)
20120 IF X<>0 THEN X$=SEG$(X$,1,X-1)+SEG$(X$,X+1,255) \ GO TO 20110
20210 PRINT #2,X$
20220 IF F1=1 THEN PRINT X$
20230 RETURN
20232 REM ------------------------------------------- END SUBROUTINE 20010
32767 END

READY
```

S a m p l e R u n

```
    The listing below is a packed version of PACKER  (Pass 1).


    RUN $PACKER


    ENTER THE NAME OF THE FILE TO BE PACKED.
    USE THE FORM  XXN:FILNAM.EXT WHERE
    XX = THE DEVICE NAME.  N = THE DEVICE NUMBER.
    ? DX1:PACKER.NEW

    ENTER THE NAME OF THE FILE FOR THE PACKED CODE USING THE SAME CONVENTIONS.
    ? DX1:PACKER.B

    ESTIMATE THE NUMBER OF BLOCKS NEEDED FOR THE PACKED FILE.
    HOW MANY ? 8

    THE MAXIMUM LINE LENGTH IS 132 CHARACTERS.
    HOW MANY CHARACTERS PER LINE ? 133

    THE MAXIMUM LINE LENGTH IS 132 CHARACTERS.
    HOW MANY CHARACTERS PER LINE ? 132

    DO YOU WANT A PACKED LISTING AT THE TERMINAL (YES OR NO) ? Y

    DO YOU WANT A LIST OF REFERENCED LINE NUMBERS (YES OR NO) ? Y

    DO YOU NEED TO ENTER LINE NUMBERS INTO THE TABLE
    OF REFERENCED LINE NUMBERS (YES OR NO) ? N

    PLEASE WAIT WHILE THE FIRST PASS BUILDS THE TABLE OF REFERENCED LINE NUMBERS.


     310          365          340          370          395
     410          5010         445          450          610
     6010         7010         8010         520          13010
     630          5040         12010        5020         6050
     7050         7030         9010         10010        8060
     8070         11010        8080         9030         9020
     10060        10090        10110        11030        11085
     11130        11140        12040        12080
    39  REFERENCED LINE NUMBERS.
```

```
 THE FIRST PASS IS COMPLETE.
 PLEASE WAIT ONE MOMENT WHILE PASS2 IS LOADED.


 160COMMONL(300),L,I,F1,B,I$,O$\DIMT$(30)\M=300\B=0\F1=0\F2=0\F3=0\I=0\L=0\PRI
 NT\PRINT'ENTER THE NAME OF THE FILE TO BE PACKED.'
 220PRINT'USE THE FORM  XXN:FILNAM.EXT WHERE'\PRINT'XX = THE DEVICE NAME.  N =
  THE DEVICE NUMBER.'\INPUTI$
 250PRINT\PRINT'ENTER THE NAME OF THE'FILE FOR THE PACKED CODE USING THE SAME
 CONVENTIONS.'\INPUTO$
 270PRINT\PRINT'ESTIMATE THE NUMBER OF BLOCKS NEEDED FOR THE PACKED FILE.'\PRI
 NT'HOW MANY ';\INPUTB
 310PRINT\PRINT'THE MAXIMUM LINE LENGTH IS 132 CHARACTERS.'\PRINT'HOW MANY CHA
 RACTERS PER LINE ';\INPUTL\IFL>132THEN310
 340PRINT\PRINT'DO YOU WANT A PACKED LISTING AT THE TERMINAL (YES OR NO) ';\IN
 PUTX$\X$=SEG$(X$,1,1)\IFX$='Y'THENF1=1
 365IFX$<>'Y'THENIFX$<>'N'THEN340
 370PRINT\PRINT'DO YOU WANT A LIST OF REFERENCED LINE NUMBERS (YES OR NO) ';\I
 NPUTX$\X$=SEG$(X$,1,1)\IFX$='Y'THENF2=1
 395IFX$<>'Y'THENIFX$<>'N'THEN370
 410PRINT\PRINT'DO YOU NEED TO ENTER LINE NUMBERS INTO THE TABLE'\PRINT'OF REF
 ERENCED LINE NUMBERS (YES OR NO) ';
 430INPUTX$\X$=SEG$(X$,1,1)\IFX$='Y'THENGOSUB5010
 445IFX$<>'Y'THENIFX$<>'N'THEN410
 450PRINT\PRINT'PLEASE WAIT WHILE THE FIRST PASS BUILDS THE TABLE OF REFERENCE
 D LINE NUMBERS.'\OPEN1$FORINPUTASFILE1
 520IFEND#1THEN610\INPUT#1,T$\X$=T$\GOSUB6010\T$=X$\X$=T$\GOSUB7010\N=X\GOSUB8
 010\GOTO520
 610PRINT\PRINT\IFF2=1THENGOSUB13010
 630PRINT\PRINT'THE FIRST PASS IS COMPLETE.'\PRINT'PLEASE WAIT ONE MOMENT WHIL
 E PASS2 IS LOADED.'\PRINT\PRINT\CHAIN'PACK2.B'
 5010PRINT\PRINT'ENTER 0 TO STOP.'\PRINT
 5020INPUTL$\IFL$='0'THENRETURN
 5040GOSUB12010\GOTO5020
 6010V=POS(X$,' ',1)-1\Y$=SEG$(X$,1,V)\X$=SEG$(X$,V+1,255)\IFF3=1THENIFSEG$(X$
 ,2,4)<>'REM'THENF3=0\L$=Y$\GOSUB12010
 6050RETURN
 7010X=0
 7030Y=POS(X$,'Y',1)\IFY=0THENX=X+1\T$(X)=X$\RETURN
 7050X=X+1\T$(X)=SEG$(X$,1,Y-1)\X$=SEG$(X$,Y+1,255)\GOTO7030
 8010FORW=1TON\T8$=T$(W)\T9$=T8$\GOSUB9010\T8$=T9$\Y$=SEG$(T8$,1,2)\IFY$='GO'T
 HENTO$=T8$\GOSUB10010
 8060IFY$='ON'THENTO$=T8$\GOSUB10010
 8070IFY$='IF'THENT1$=T8$\GOSUB11010
 8080NEXTW\RETURN
 9010T9$=TRM$(T9$)\IFT9$=''THEN9030
 9020IFSEG$(T9$,1,1)=' 'THENT9$=SEG$(T9$,2,255)\GOTO9020
 9030RETURN
 10010X=LEN(TO$)\X$=SEG$(TO$,X,X)\IFPOS('0123456789',X$,1)=0THENRETURN
 10060FORZ=XTO1STEP-1\X$=SEG$(TO$,Z,Z)\IFX$=' 'THENL$=SEG$(TO$,Z+1,X)\GOSUB120
 10\RETURN
 10090IFX$=',THENL$=SEG$(TO$,Z+1,X)\GOSUB12010\TO$=SEG$(TO$,1,Z-1)\GOTO10010
 10110NEXTZ
 11010X=POS(T1$,'THEN',1)+4\IFX=4THENF3=1\TO$=T1$\GOSUB10010\RETURN
 11030T1$=SEG$(T1$,X,255)\T9$=T1$\GOSUB9010\T1$=T9$\X$=SEG$(T1$,1,1)\IFPOS('01
 23456789',X$,1)<>0THENTO$=' '+T1$\GOSUB10010\RETURN
 11085F3=1\X$=SEG$(T1$,1,2)\IFX$='IF'THEN11010\IFX$='ON'THENTO$=T1$\GOSUB10010
 11130IFX$='GO'THENTO$=T1$\GOSUB10010
 11140RETURN
 12010X=VAL(L$)\FORY=1TOI\IFL(Y)=XTHENRETURN
 12040NEXTY\I=I+1\L(I)=X\IFI=M+1THENPRINT'TOO MANY REFERENCED LINE NUMBERS.'\S
 TOP
 12080RETURN
 13010FORX=1TOI\PRINTL(X),\NEXTX\PRINT\PRINTI;' REFERENCED LINE NUMBERS.'\RETU
 RN\END


 THE FILE THAT WAS PACKED IS  DX1:PACKER.NEW
 THE PACKED PROGRAM IS STORED UNDER  DX1:PACKER.B

 STOP AT LINE 240

 READY
```

Test the packed file to see that it does not generate the ?TLT error message.

```
OLD DX1:PACKER.B

READY
```

No error message indicates that the packed file will run as a logical replica of the original.

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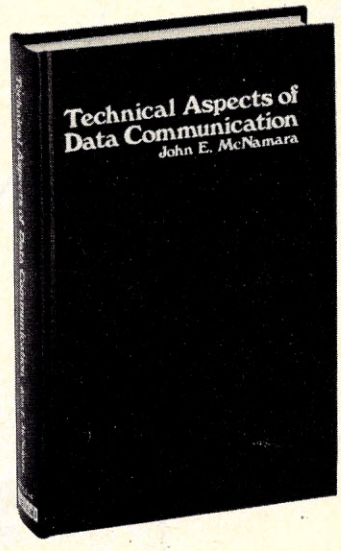

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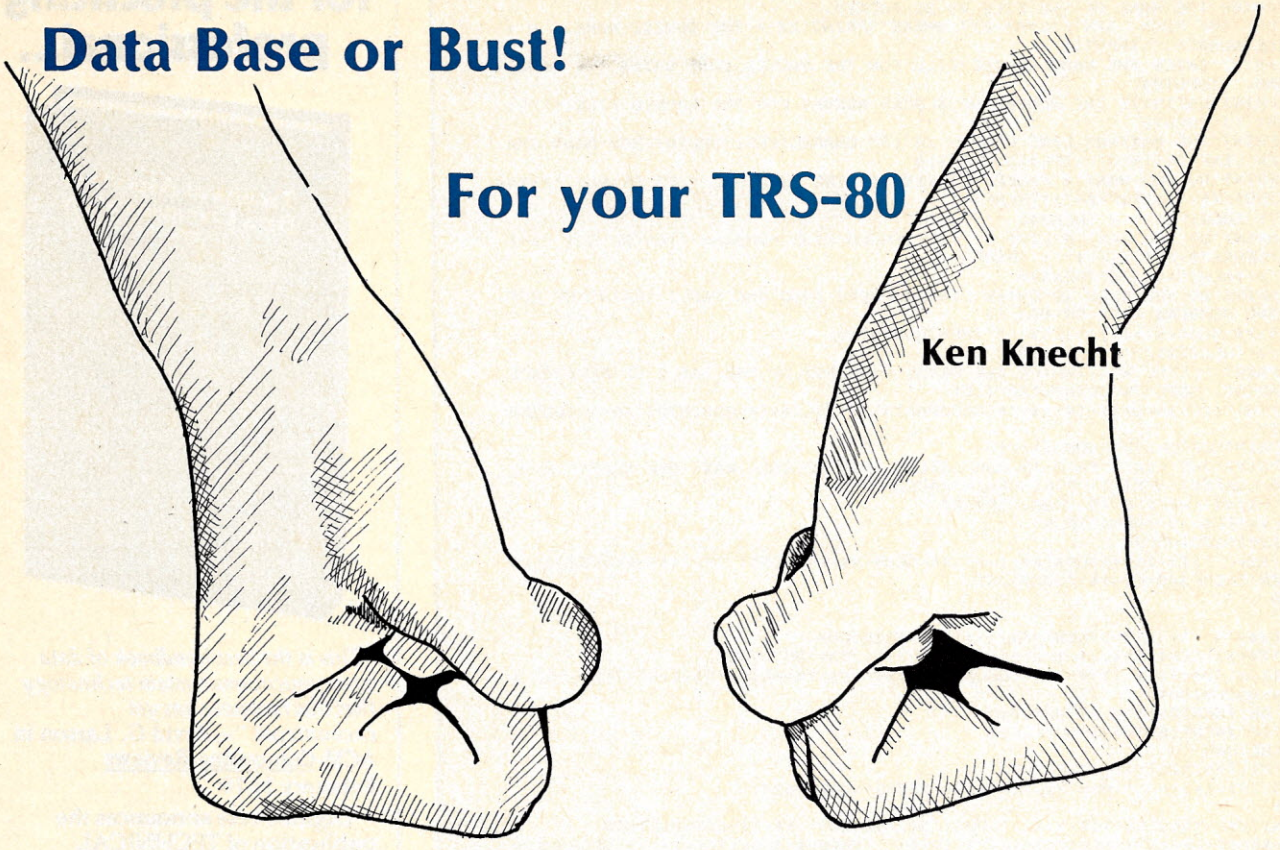

If you're ready for an inexpensive information retrieval system for your disk-based TRS-80, perhaps this is the one.

File-It is a program designed to store a data base consisting of three fields (of any size). Thus perhaps a name, phone number and address, or a product, part number and price, and manufacturer. It is a useful program and will store almost any data base you require. As the program is provided you are limited to three fields. However, the documentation tells you how to change the number of fields (just change a number in a DIM statement), and also the number of records in a file.

The whole file is placed in memory, as an array, when the file is called, so the program runs very rapidly. This also has another advantage. The file can be stored in a sequential file, much more space efficient than using random access. Also, this means the field sizes are not fixed in length. The obvious disadvantage is that your available RAM limits the size of the file. If you have 32K this should be no problem.

In running the program several options are available. One is to retrieve the information filed and another is to change data in a file. You can also look at each field in a file, searching for a key field, then print out the records containing this key field. Note I said key field, not key word. That is, the whole field has to be the same as the key searched for.

Ken Knecht, Kencom Co., 1890 W. Colorado St. #7, Yuma, AZ 85364.

Criticisms

Personally, I would rewrite the program to use the INSTR() function in disk BASIC to search each field for a key word appearing in a record. Of course this would be slower and occasionally retrieve some nonsense, but on the whole I believe it would make the program more useful. It would be simple enough to modify the program to do this; you could even make it optional and specify the search method each time you selected this program mode.

Another criticism is the use of the INPUT statement to input data to the file. This restricts you to data which does not contain a comma, colon, leading blank or quote. I would change the statement to LINE INPUT, which accepts anything up to a carriage return.

The documentation received with the program is a bit sketchy and requires rereading and operation of the program to understand. However, once you use the program and experiment with it a bit you'll have no trouble. My understanding is that more detailed documentation is being prepared.

Summary

This program is provided on a diskette and is packed in a nice thick carrier. I doubt that even the USPS could damage it. The version I received is for the TRS-80 and also contains a copy of TRSDOS so it can be used with a single disk system. Note FILE-IT is not a SYSTEM program, but is written in BASIC, so it is easy to modify it to do whatever you wish.

In my opinion, FILE-IT is a very useful program and easily used due to its simplicity. The few criticisms I have can be corrected by the purchaser (with a knowledge of BASIC). It is available for $25 from Jeff Lasman's Practical Applications, PO Box 4139, Foster City, CA 94404. ■

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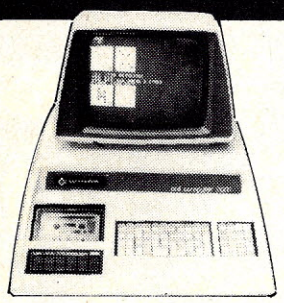

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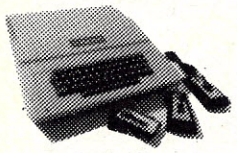

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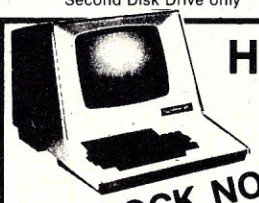

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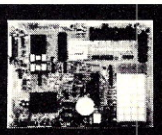

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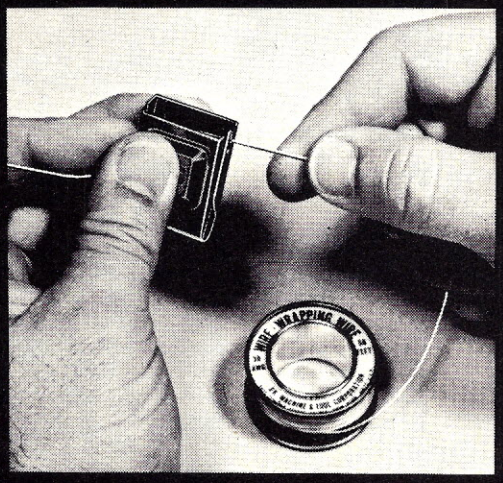

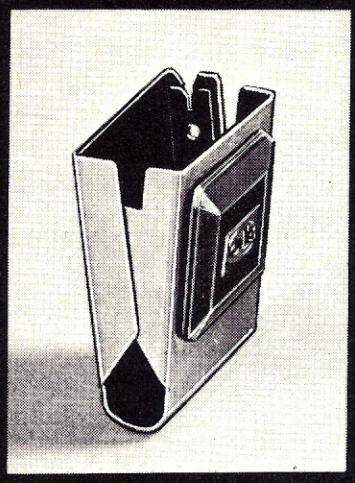

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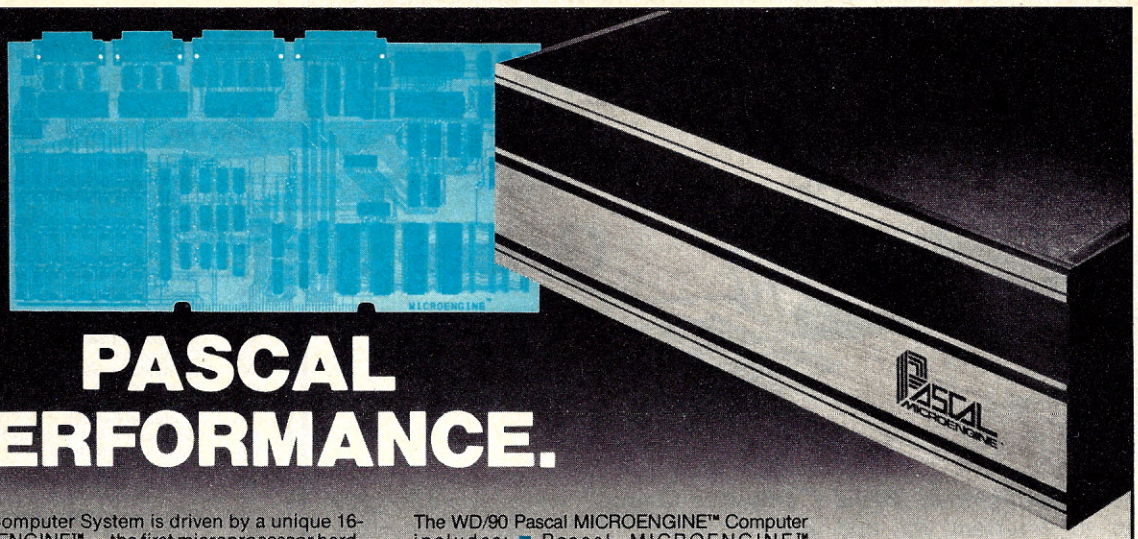

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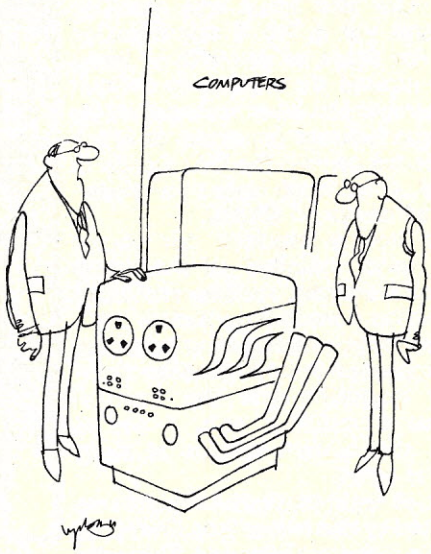

"... and this one does 60 integer executions in 7.2 nanoseconds..."

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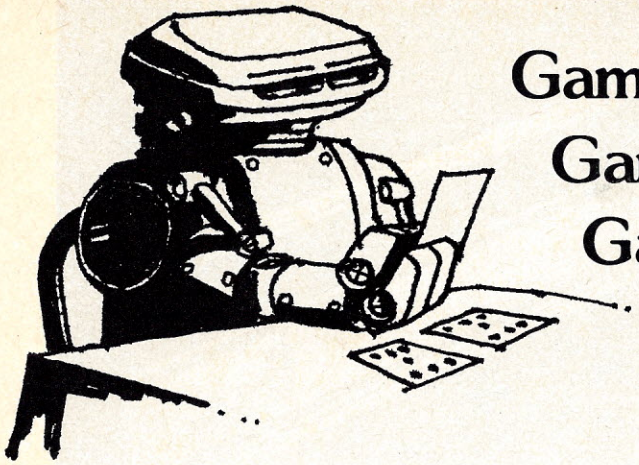

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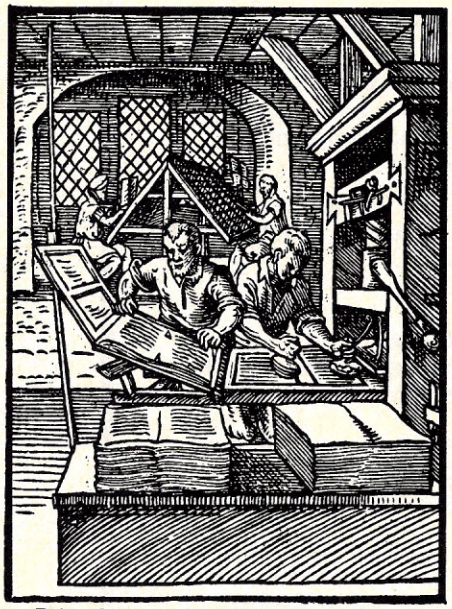
Yes, folks, *Creative Computing* has been around for four (count them, 4) years! Our first issue was Nov/Dec 1974 and Vol. 4, No. 6 was Nov/Dec 1978. For those of you with all those issues around it's sometimes difficult to remember just when that neat article on Magic Squares appeared, or which four issues carried the CAI Series of articles, or in which issues we reviewed all 34 books on BASIC.

Also, not to overlook our cousin ROM, we've included all the meaty articles, programs, reviews and other information from that periodical too.

We've cross-referenced articles that have appeared in both *Creative Computing* magazine and the *Best of Creative Computing Vols. 1 and 2*, hence, the current source of every article is listed.

Articles are classified by subject area and listed by title and author. Over 2000 separate items are included. The index does not include a cross-reference to author.

The index was put together by Jane Fletcher on a DECsystem-10 using the text editor and runoff (with a Diablo 1620).



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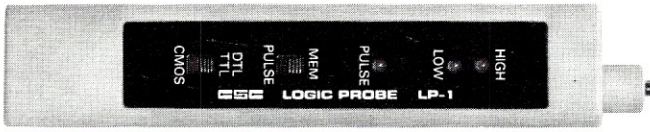

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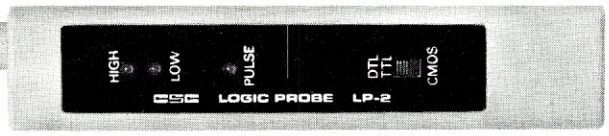

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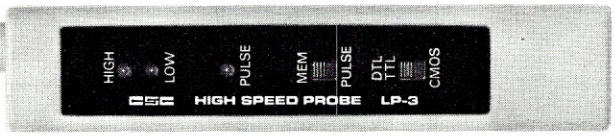

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